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AUTOMATIC CONTROL*

THE conception of automatic control arises basically from the use of devices which measure the departure of the physical state of a system from a desired normal, and the utilisation of this information to restore, by mechanical or electrical means, the system to the normal state. Many and varied devices of this kind have existed for a long time. Every steam engine had its governor and a patent was filed for a D.C. cross-field generator to give constant current as far back as 1882. The automatic pilot was flying aeroplanes in 1925 and one of the several fields of automatic control that was already entering upon a phase of active development before the war was that of the automatic control of quantities involved in the manufacture of chemical products, the field now often referred to as process control. What is new is the emergence in recent years of a philosophy of automatic control, a change of out-

look based on the recognition of a common basis of principle in a great variety of engineering devices. And it is precisely this recognition that is mainly responsible for the present acceleration of progress in all the many fields of application from sensitive self-balancing bridges for measuring purposes to power machinery like rolling mill drives.

It is probable that the development of the feed-back thermionic amplifier was the decisive contribution in weaving these various strands of development into a unified pattern. The main theoretical concepts that enable us to deal so effectively with so large a variety of control problems were nearly all first developed in connection with the use of feed-back in amplifiers. It was in this connection that Nyquist, in 1932, developed the criterion of stability now known by his name, that has played so important a part in the development of all forms of automatic control.

The perception of the essential identity of the basic problems in these various fields was accelerated by the pressure of war requirements. The rapid solution of many automatic

* Abstract of the Presidential Address of Sir Ben Lockspieser, at the opening of the D.S.I.R. Conference on Automatic Control at the Royal College of Aeronautics, Cranfield, England,

and manual control problems became of first importance, as may be appreciated on recalling such examples as the automatic gun layer, the automatic tracking of targets or the control of guided missiles. The solution of these problems led to the production of many new elements suitable for use in control systems. But the outstanding result of the stimulus of war on the development of automatic control was this appreciation, for the first time, of the essential unity of the subject, including mechanical servo-systems, automatic controls as used in the chemical industry, feed-back amplifiers, both of the thermionic, rotary-machine and static-magnetic types, and in fact the possibility of bringing under the control of a common scheme of analysis all those systems in wide fields of engineering and elsewhere that involve what is called a 'closed sequence of dependence.'

The scope of this conception was soon seen to extend even beyond engineering. There is no doubt that in biology, in economics, and perhaps even in still wider fields, this conception of the closed sequence of dependence, and the characteristics of system behaviour associated with it, may prove to be a valuable tool of thought, and in some cases a means to the formulation of problems in these difficult fields in such a way that the analytical methods already worked out by engineers may be brought to bear on them.

The subject of automatic control is of outstanding importance, both in connection with industrial development and the increase of pro-

ductivity, and also with defence requirements. Writers of eminence have not been lacking, particularly in the United States, who have seen in the development of automatic control systems an important contribution to the emergence of an entirely new type of industrial era. There is some disparity between such views of the future potentialities of automatic control and the somewhat slow, though steady and important progress that has been made so far in the application of automatic controls in industry.

It may be true that if economic considerations are set aside, there are now only remote limitations to the technical possibilities of devising mechanisms that will carry out certain kinds of functions usually performed by human muscular skills, but, in fact, the economic considerations remain and it is an important purpose of a Conference of this kind to make the sort of progress that in the long run will result in the production of simple and, therefore, cheaper equipment. Several of the papers to be discussed during the Conference are concerned with the alternative ways in which a given specification of requirements may be met and the possibilities of devising procedures in design that will indicate the optimal design without the inordinate amount of labour and calculation that is at present involved in the design of such systems. Such developments, if they can be carried to a successful conclusion, will also help to cheapen the application of automatic control and so widen its field of use.

INTERNATIONAL COMPUTATION CENTRE

THE International Computation Centre proposed by the UNESCO is to have the following functions in the fields of Research, Education and Service:

(1) to organise study and scientific research on questions relating to the use and development of Mechanical Computation devices, in particular to establish, in co-operation with scientific organizations concerned, a programme of pure science problems to be studied on the international level; to publish and circulate in appropriate form the results of the research which it has undertaken; to promote collaboration between computing institutes throughout the world, to assist in the co-ordination of their work, and to promote their activities;

(2) to organise and develop a programme for the training and improvement of research

workers in the field of Mechanical Computation; and, to this end, establish and maintain one or more laboratories equipped with various types of calculating machines and requested to carry out numerical computations.

Also it has been recommended that UNESCO should create and administer the Centre and should secure for it the resources necessary for its functioning. The proposed budget for the first year is \$220,000, mounting to \$300,000 in the third year.

Three countries—Italy, the Netherlands, and Switzerland—have offered to act as host for the proposed Centre, but no decision is to be made until a final report is presented to a suggested meeting in November of accredited delegates from different countries when the Centre will be set up officially.

A RATIONAL METHOD OF APPLYING SULPHATE OF AMMONIA TO RICE

K. RAMIAH, M. V. VACHHANI AND C. T. ABICHANDANI

(Central Rice Research Institute, Cuttack)

RICE is a semi-aquatic plant and is mostly grown in swampy and anaerobic condition. A large number of investigations has been conducted to evaluate the response of the crop to the application of nitrogenous fertilizers. Among such fertilizers, sulphate of ammonia has been found to be the best, though the response may vary with different soil and other environmental conditions, (Sethi;¹ Ramiah *et al.*²). According to Dastur *et al.*,³ rice plants unlike other crops uses ammoniacal nitrogen in early stages and nitrate nitrogen in later stages of its growth. Field experiments with a mixture of ammonium nitrate and ammonium sulphate did not however establish the superiority of the mixture over sulphate of ammonia.

Efficient use of fertilizer can result only when the fertilizing element is utilised by the plant to the maximum extent. The present method of applying sulphate of ammonia to rice throughout India consists of spreading the fertilizer on the surface in wet condition immediately after transplanting the crop or somewhat later. Immediately on application, ammonia which is in the most reduced condition of the nitrogenous compounds is partly utilized by the plant directly and the rest is converted into nitrates by oxidation. Nitrate which is the highly oxidized form of the nitrogenous compounds does not undergo any further change in the surface layer and since it is not absorbed by the soil colloids, it leaches down to the lower layer with the percolation water and some of it is drained off with the free water. Russell⁴ states that the work of Prof. Pearse has indicated that under marshy conditions oxidation takes place only near the soil surface and reduction down below. The nitrates formed on the surface when they get down to the lower reductive layer are reduced and gaseous nitrogen in the form of NO or N₂ is formed which is lost. Thus there is loss of nitrogen both as nitrates and free nitrogen gas and the full benefit of the fertilizer application is not obtainable.

The practical aspects of this finding have been recognised and made use of by Japan in their rice manuring practices.⁵ In Japan, two-thirds of the nitrogen dose as sulphate of ammonia is applied in the dry condition of the soil 2"-3" below the surface a few days before water is let into the fields for puddling and transplanting. The other one-third is ap-

plied later when the plant is growing and even here, the sulphate of ammonia is first made into balls or pellets mixed with clay, and these are thrust into the soil a few inches deep. Their investigations have shown that ammonium sulphate applied directly in the reductive layer remains stable and the plant utilizes it gradually. Thus the loss of nitrogen is minimized and it has been estimated that the efficiency of sulphate of ammonia applied in this way is 50-70 per cent. as against 20-30 per cent. only with the usual wet application.

To test this method of 'dry' application in the lower layers an experiment has been conducted at Central Rice Research Institute, Cuttack, under medium and low land conditions during two crop seasons, 1949-50 and 1950-51. The quantity of nitrogen applied was 20 lb. per acre and the application of nitrogen resulted in a significant increase in yield, the response being about 268 lb. of grain over a control yield of 1087 lb. per acre. Between the two methods of applying sulphate of ammonia, on the surface of wet soil or 2-3 inches below the surface in dry condition, the latter has given a consistently higher response though the differences between the two methods were not always significant. The average yield response for the two methods per lb. of nitrogen applied is given below:

TABLE I

Average of response of paddy in lb. per acre
for every lb. of N applied

	Dry application	Wet application
Medium land	.. 14.2	9.4
Low land	.. 19.3	11.9
Mean	.. 16.8	10.7

The above data clearly indicate that the dry method of applying sulphate of ammonia is more efficient than the usual wet method.

In large rice areas of N. E. India, Assam, Bihar, Bengal and Orissa, rice is sown in the dry condition of the soil at or just before the break of the monsoon. Under such conditions, the application of sulphate of ammonia in the dry soil inside the plough furrows does not present any difficulties and should prove more efficient than later application when the monsoon is on in full swing. Where however the land

is not ploughed in the dry condition but puddled after first letting in the water, this dry application is not feasible.

To meet this situation another experiment on deep placement has been conducted at Central Rice Research Institute for two seasons. The required amount of sulphate of ammonia was mixed with 5 to 10 times its weight of soil and made into a soft dough with water. Small balls of about 1" in diameter were then made from this material and dried. These balls were thrust 2"-3" deep into the soil between rows of standing crop 12"-18" apart at the time of weeding in a transplanted crop or at the time of bushening in a broadcasted crop. It has been found that this method of application is much more efficient than the wet surface application as shown by the figures given in Table II.

The efficiency of the deep placement is 2.5 times that of the surface application. There is an indication that the response for 20 lb. N placed deep can be just as good as 40 lb. N applied on the surface.

While the detailed results of these trials will be published elsewhere, the experiments are

TABLE II

Results comparing 20 lb. of nitrogen applied as ammonium sulphate either on the surface or deep-placed

	Earheads per plant	Mean height per plant (cm.)	Yield lb. per acre	
			grain	straw
No nitrogen	.. 5.3	115.8	1575	1926
Surface application	.. 5.8	120.5	1698	2089
Deep placement	.. 6.3	126.0	1895	2395

being continued and arrangements are also in progress to test the dry application and deep placement on a large scale in the cultivators' fields.

1. Sethi, R. L., *I.C.A.R. Bull.*, 1943, No. 38, 2.
 Ramiah, et al., App. II (b) to *I.C.A.R. Report on soil fertility investigations in India*, 1947, by Dr. A. B. Stewart.
 3. Dastur, et al., *Ind. Jour. Agri. Sci.*, 1933-34, 3, 963, and 4, 803. 4. Russel, E. J., *World Crops*, 1949, 1, 2, 726. 5. Dr. Morinaga, *Unpublished note*.

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

IN the course of his address at the opening of the Indian Institute of Technology, Kharagpur, the Hon'ble Maulana Abdul Kalam Azad observed as follows:

"The Institute which is being inaugurated today will have provision for the teaching of 2,000 students at the undergraduate level, and 1,000 students for post-graduate study and research drawn from all over the country.

"In order to ensure that the Institute serves the needs of the country in the most effective manner, the course in the Institute will be planned on the advice of experts drawn from industry, Government Departments, other employing agencies and educational authorities. In fact, this close association between academic experts and practical administrators is essential for the proper development of an institution of this type. I would like to make a special appeal to our industrial and business magnates to take an active interest in the development of this Institute. They can help in many ways. Industry can assist financially by establishing Chairs in subjects in which it is especially interested. Such assistance would make it possible to have Professors, where necessary more than one, in subjects which are important from the point of view of the development of industry. I have no doubt that in-

dustrialists will also help to make the training in this Institute more practical and concrete by permitting students to visit Workshops and Factories and allowing them to go through organised courses of practical training in the industry. It will improve the quality of teaching in the Institute, and in the end help industrialists themselves, if staff members of the Institute are offered facilities for the study of industrial techniques. Promising employees should also be seconded to the Institute to undertake programmes of research or courses at the post-graduate level. Last but not least, industrial magnates can help by deputing engineers, technologists, and administrators in their concerns to deliver lectures or courses of lectures at the Institute.

"Though situated in one corner of India, this Institute is intended to cater to the needs of the country as a whole. We have been able to recruit very distinguished men to take charge as Professors in the different departments, and we are happy that a scientist of the calibre of Dr. J. C. Ghosh is its first Director. I have no doubt that they will devote themselves to building this institution on sound foundations so that it may take its place as one of the finest institutions of its kind not only in India but in the world."

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INCOMPLETE BLOCK DESIGNS

IN connection with a recent note¹ by A. A. K. Iyengar in *Current Science*, it appears that while writing the note, the author had not with him the information on two earlier important papers by Bose² and Shrikhande.³ Bose² has used the same method of matrix representation to prove that $b \geq v$. Shrikhande³ has also used virtually the same principles to prove the impossibility of certain symmetrical balanced incomplete block designs, of which the example, $v = b = 46$, $r = k = 10$, $\lambda = 2$ quoted by Ayyangar is a particular one. Further, the symmetrical determinant NN' of Bose and Shrikhande is exactly the same as the determinant $X'X$, which

was used earlier in connection with "weighing designs".^{4,5}

Pusa, Bihar,
June 13, 1951.

K. S. BANERJEE.

1. Krishnaswamy Ayyangar, A. A., 1951, 20, 93. 2.
2. Bose, R. C., *Annals of Math. Stat.*, 1949, 619-20. 3.
3. Shrikhande, S. S., *Ibid.*, 1950, 106-11. 4. Banerjee, K. S., *Ibid.*, 1948, 394-99. 5. — *Ibid.*, 1949, 300-04.

THE geometry of finite projective planes initiated by Veblen and Bussey, the Incomplete Block Designs due to Fisher and Yates and the weighing problem of Yates and Hotelling have a common mathematical basis, which has been

worked out by many recent writers in several journals. The matrix representation $X = \{x_{\mu}\}$ plays a fundamental part in all of them, as also its sequel, the determinant $|X'X| = A$ first used by Harold Hotelling¹ in his basic paper in 1944. This paper has been the inspiration of subsequent developments by Mood Kishen, Banerjee and others.

The determinant $|X'X|$ was next thought of by Bruck and Ryser in 1949 to prove the non-existence of certain finite projective planes² and by Ryser to prove a property of incomplete block designs.³ While reviewing Schützenberger's theorem⁴ in the *Mathematical Reviews*, 1950, 11, 3, H. B. Mann points out that the proof can be considerably simplified by computing AA^T instead of A directly. I had not noticed this remark prior to my historical note⁵ where I had referred to the shorter proof of Chakrabarti which is just on the lines hinted at by Mann.

More recently, Chowla and Ryser,⁶ following the earlier work of Bruck and Ryser have given simple and elementary methods of proof which lead to results more comprehensive than those in Schützenberger's.

A. A. KRISHNASWAMI AYYANGAR.

Mysore,
August 4, 1951.

1. Harold Hotelling, *Annals of Math Stat.*, 1944, 15.
2. Bruck, R. H., and Ryser, H. J., *Canadian J. Math.*, 1949, 1.
3. Ryser, H. J., *Proc. Amer. Math. Soc.*, 1950, 1.
4. Schützenberger, M. P., *Annals of Eugenics*, 1949, 5.
5. Ayyangar, A. A. K., *Curr. Sci.*, 1951, 20.
6. Chowla, S., and Ryser, H. J., *Canadian J. Math.*, 1950, 2.

KIRTHAR FORAMINIFERA FROM RAJASTHAN

KIRTHAR foraminifera have been described from Western Pakistan,¹ Cutch² and Kathiawar. The Pellatispira bed of the Surat-Brosch area to which an Upper Eocene age has been assigned³ is considered to be post-Kirthar and the new name Tapti series⁴ has been suggested for the Pellatispira-bearing beds of India, Pakistan and Burma. In Rajasthan the only Eocene horizon hitherto recognised is the Laki equivalents of the Bhadrar beds of the Salt Range containing *Assilina daviesi*, *A. spinosa* and *Orbitolites complanata*. *N. irregularis* has not been recognised in these beds. The present discovery of beds containing Kirthar foraminifera from Kolayat, near Bikaner, is of considerable interest. The Kirthar beds are here exposed as outliers surrounded by Laki beds

which seem to be the continuation of the Palana Laki sequence.

The Kirthar beds have yielded the following foraminifera:—*N. cf. maculatus*, *Discocyclus* (sellate forms), *Dictyoconoides cooki*, *Floresculina* sp., *Linderina* sp., *Planorbulina* sp., *Heterostigina* sp. This fauna is distinct from that of the Laki, and the presence of *N. cf. maculatus*, Nuttall² fixes the age as lower part of the Middle Kirthar.

Investigation of this fauna (under the guidance of Mr. S. R. Narayana Rao) is in progress and detailed account will be published elsewhere.

Department of Geology,
Lucknow University,
May 12, 1951.

S. N. SINGH.

1. Davies and Pinfold, *Pal. Ind. N. S.*, 1937, 24, (1).
2. Nuttall, *Rev. Geol. Surv. Ind.*, 1926, 59, Pt. I, 115-64; Vredenburg, *Ibid.*, 1906, 34, 79-95.
3. Narayana Rao, *Journ. Mys. Uni.*, Sec. B, 1941, 2, (2), 5-17.
4. Eames, *Abstr. Proc. Geol. Soc., London*, No. 1463, 30-34; Nagappa, *Proc. Ind. Acad. Sci.*, 1951, 33, 41-48.

CLOUDED FELDSPARS IN BASIC DYKES OF CHARNOCKITIC AREAS

It will be seen from the geological map of the Mysore State published by the Mysore Geological Department, or from the geological sketch map of the Biligirirangan area given by Mr. B. Rama Rao,¹ that there are a few prominent dolerite dykes running west to east, and, therefore, trending almost at right angles to the prevailing north to south strike of the rocks of this region. These dykes cut both the Peninsular gneisses and the Charnockites. Many of these dykes have chilled margins and so must be considered later in age than the country rocks.

During a recent visit, specimens of the basic dykes of this area were collected by the writer, and when thin sections of these rocks were examined under the microscope, it was found that the plagioclase feldspars, without any exception, exhibited the phenomenon of clouding.

This cloudiness of the feldspars is not to be confused with the turbidity caused by decomposition. The clouded feldspars of the Biligirirangan are not altered but quite fresh, and the multiple twinning of the plagioclases are seen distinctly between crossed nicols.

In ordinary transmitted light, thin sections of clouded feldspars are either brown or grey in colour. Under high power, this cloudiness is seen to be caused by the presence of very fine inclusions which are in the form of minute

specks or tiny rods. There is usually no uniformity either in the depth or in the distribution of clouding even in a single crystal. The discoloration, therefore, is found to be somewhat patchy. Sometimes, these microscopic specks or rods are arranged in streaks parallel to the traces of the twinning planes. In some of the dykes the clouded feldspars also contain acicular inclusions disposed at angles of 60° and 120°, features considered to be characteristic of the charnockites.²

Apart from the Biligirirangan area, there is another region in the Mysore State which is characterised by the occurrence of charnockites. This lies in the south-west of the State comprising the area south of Fraserpet in Coorg, and west of Periyapatna. The basic dykes here were microscopically examined, and it was seen that the plagioclase feldspars were clouded.

A preliminary examination of thin sections of dykes occurring in the charnockitic area south-west of Sakleshpur in the Hassan District, and near Sivasamudram in the Mandya District, has shown that practically all the dykes there contain plagioclase feldspars which are clouded to varying degrees of intensity.

This naturally led the writer to investigate whether the dykes in charnockite areas outside Mysore State also contained clouded feldspars. It has not, of course, been possible to examine all the dykes of these regions but brief visits to Pallavaram, Mettur and the Nilgiris enabled the collection of some of the dykes occurring in these typical charnockite zones. Every one of these dykes when examined under the microscope was found to be characterised by the presence of clouded plagioclases.

Sir Thomas Holland's description of one of the dykes in the Shervaroys—another typical charnockite area—leaves no room to doubt that when he states "the plagioclase is generally brown through included dust",³ he is referring to the phenomenon of clouding.

During a recent visit to Ceylon, the writer scoured the highlands, which is charnockitic, for basic dykes but was unable to locate any. The dykes on the coastal plain, which are mainly in gneissic country, do not contain clouded feldspars.

The phenomenon of clouding in plagioclase feldspars has become a valuable criterion in the elucidation of the metamorphic history of a region ever since A. G. MacGregor⁴ drew attention to the fact that clouding in plagioclases is produced in a rock that has been subjected to regional—or contact—thermal metamorphism, and that it is not an original feature of the feldspar crystallisation period, or a deuteric

effect that arose at a late stage in the consolidation period.

The dark colour of the charnockites is considered to be caused by the presence of acicular inclusions in the usually light coloured minerals, quartz and feldspar. The general association of dykes containing clouded feldspars with charnockites bearing greasy grey or blue quartzes and feldspars, requires explanation. As already stated, in some clouded feldspars in basic dykes the minute specks or rods give place to longer acicular inclusions. This seems to indicate that both the basic dykes and the charnockites have together suffered regional-thermal-metamorphism at some later date. The relative age as inferred from the chilled edges of the dykes, precludes the possibility of the charnockite intrusion having affected the plagioclases of these basic rocks.

C. S. PICHAMUTHU.

Mysore Geological Dept.,
Bangalore 1,
July 20, 1951.

1. Rama Rao, B., *Mys. Geol. Dept. Bull.*, No. 18, 1945, Plate III facing p. 105. 2. Holland, T. H., *Mems. Geol. Surv. Ind.*, 1930, 28, Pt. II. 3. —, *Ibid.*, 1901, 30, Pt. II, p. 131. 4. MacGregor, A. G., *Mineralogical Magazine*, 1931, 22, 524-37.

ON THE NATURE AND DISTRIBUTION OF PYROPHOSPHATASE IN GUINEA PIG TISSUES

EXCEPTING Lohmann¹ who, working with fresh liver extracts, reported a specific pyrophosphatase active only in the presence of magnesium, all other workers have failed to detect this potent enzyme because they have invariably subjected the tissue materials to various treatments like autolysis, dialysis, acetone desiccation, etc., before testing for pyrophosphatase activity. It is observed that all the above treatments are highly deleterious to this magnesium activable enzyme. Having been able to demonstrate the existence of a labile magnesium activable alkaline pyrophosphatase in erythrocytes² which was overlooked by the previous workers, and having found that plasma is practically devoid of this enzyme, it is considered likely that all tissues in which glycolysis is a constant occurrence might contain this enzyme. With this object, and since guinea-pig, of all the animals investigated, showed the highest erythrocyte pyrophosphatase activity³ the tissues of an adult guinea-pig were investigated.

Fresh extracts obtained by maceration of the tissues in glass mortars were used. The dilutions

varied from 50-150 times the wet tissue weight. The pyrophosphatase activity of these tissues was measured at different pH without and with added magnesium (0.02 M), using M/35 veronal-acetate buffer and an incubation period of 15 minutes at 40° C. The results obtained with brain, heart, intestine, kidney, liver, lung, muscle and testes indicate that all these tissues show pyrophosphatase activity at such great dilutions only in the presence of magnesium, and that the maximum activity is in the pH range of 7.2-7.9.

To find whether any activity could be observed without added magnesium by prolonged incubation, separate experiments were set up with an incubation period of 2½ hours and at 37° C. While all the other tissues show negligible activity, intestine and kidney show appreciable activity at pH 8.68. These activities may be due to the action of a separate enzyme.

The magnesium activable alkaline pyrophosphatases of the tissues show resemblance to the erythrocyte enzyme in many of their properties. With 0.001 M magnesium the activation is about 10% while with 0.005 M magnesium the activity reaches 90% of the maximum, which is observed with 0.02-0.05 M. Higher concentrations produce inhibition. Calcium acts antagonistically to magnesium. Preliminary incubation with the buffer without magnesium and pyrophosphate produces marked inhibition of the tissue enzymes. The presence of magnesium or pyrophosphate protects the enzymes against this buffer inactivation. Fluoride in low concentrations is toxic to all the enzymes. Formaldehyde inhibits the enzymes indicating thereby that intact amino groups are essential for the enzyme activity. Copper and mapharside are inhibitory, and the mapharside inhibition could be reversed with cysteine. The integrity of sulphhydryl groups is, therefore, necessary for activity.

It is, therefore, concluded that all tissues contain the same potent magnesium activable alkaline pyrophosphatase as that present in erythrocytes. In the following table are given

Tissue	Units	Tissue	Units
Bone	0.5	Muscle	4.5
Brain	10.2	Prostate	13.7
Heart	22.2	Seminal vesicle	17.1
Intestine	18.0	Spleen	9.8
Kidney	16.1	Supra-renals	8.6
Liver	53.3	Testes	61.0
Lung	9.0		

the results on the relative distribution of the enzyme in different tissues of an adult guinea-pig. Each unit corresponds to one mg. of orthophosphate P liberated by the enzyme present in 1 g. of the wet tissue.

The fact that bone which is the richest source for alkaline phosphomonoesterase shows negligible pyrophosphatase activity leads to the conclusion that pyrophosphatase is distinct from phosphomonoesterase, and that it has no role in ossification, but only in glycolysis.

Details will be published elsewhere.

Chemistry Department,
Madras Veterinary College,
November 29, 1950.

B. NAGANNA,

1. Lohmann, K., *Biochem. Z.*, 1923, **262**, 137.
2. Naganna, B., and Narayanamenon, V. K., *Jour. biol. Chem.*, 1948, **174**, 501.
3. Naganna, B., *Unpublished*.

A RAPID FLUORESCENCE TEST FOR THE DETECTION OF ARGEMONE OIL IN MUSTARD OIL

IN 1941, Sarkar¹ first developed the specific ferric chloride test for the detection of argemone oil in mustard oil. This test with some minor modifications by Sen² can detect even 0.25% argemone oil in mustard oil. Since the ferric chloride test requires, sometimes, a fairly long time for the appearance of crystals, the authors have been trying for sometime past to develop a rapid but specific test. The following simple test has been found to be very useful.

1 c.c. of pure concentrated hydrochloric acid and 0.5 c.c. of ethyl alcohol (rectified spirit) are added to 2 c.c. of the suspected mustard oil in a test tube and shaken for about a minute. The test tube is then heated in a boiling water bath for about 10 minutes with occasional shaking and the contents then seen in ultraviolet light (a Hanovia fluorescence lamp has been used) in a dark room. The lower acid layer will exhibit a characteristic pinkish fluorescence if argemone oil is present in mustard oil even in 0.025% concentration. A large number of vegetable oils have been tested and the test has been found to be specific for all practical purposes.

If in the above procedure heating is omitted then the acid layer in the case of argemone adulterated mustard oil will exhibit a violetish fluorescence (bluish violet at very low concentrations and light violet at higher concentrations). The acid layer in the case of pure mustard oil or til oil under identical condition (in

cold) might show a fluorescence resembling that of the acid layer of about 0.0125% argemone oil in mustard oil immediately, but on keeping for a longer period the fluorescence will be distinctly different and there will be no difficulty in the detection of argemone adulterated mustard oil. For rapid result the heating procedure is recommended. Full details will be published elsewhere.

Our thanks are due to Indian Council of Medical Research for a research grant.

Dept. Org. Chem. & S. N. SARKAR.
Biochem., D. L. NANDI.
Nilratan Sarkar Medical College,
Calcutta,
February 12, 1951.

(d) The use of catalysts, except MnO_2 , did not increase the capacity.

(e) The prior treatment of the coal sample by solvent extraction did not appreciably change the capacity.

(f) The maximum values for capacity obtained so far were 1.5 to 1.55 m. eq./gm. bone-dry exchanger. The value obtained for 'Catex' (Inflico) under similar conditions was 1.47.

A detailed account will be published shortly elsewhere. Further work on the lignitic and other varieties of coal is in progress.

Nat. Chem. Lab. of India, S. L. BAFNA,
Poona 7, M. U. PAI,
May 28, 1951. H. A. SHAH.

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- Heymann, E., and O'Donnell, I. J., *J. Colloid Sci.*, 1949, **4**, 395.

CARBONACEOUS EXCHANGERS BY SULPHONATION OF INDIAN COAL

CARBONACEOUS cation exchangers, obtained by sulphonation or alkaline oxidation of natural materials like coal, peat, lignite, etc., are well known and are available in market under various commercial names. However, few data are available on the systematic study of these processes.¹ The present work has been undertaken with a view to study the suitability of Indian coals and lignites for the preparation of carbonaceous ion exchangers. A sample of a medium-quality semi-bituminous coal was ground to (-20, +60 mesh), sulphonated at different temperatures for two hours, and then left overnight at room temperature. The final product (-20, +60 mesh) was regenerated with HCl, air-dried and stored in stoppered bottles. The moisture content was determined by heating at 102-107° to a constant weight, and the capacity due to strongly acidic sulphonic acid type groups, was estimated by finding the limiting exchange value with $BaCl_2$ solution.² The results were reproducible within 4% and the conclusions, from the data obtained till now are briefly summarised below:

(a) The capacity increases with the increase in the ratio of H_2SO_4 to coal, the ratio varying from 1 to 3.

(b) Sulphonation with 5% fuming sulphuric acid gives better results than those by ordinary sulphuric acid ($d = 1.83$).

(c) The capacity increases up to a sulphonation temperature of 90°, but further increase in temperature (to 200°) decreases the capacity.

STUDIES OF A SYNTHETIC CATION EXCHANGE RESIN

BELOW are summarised briefly the results obtained from the study of a sample of cation exchange resin,¹ termed here as HP-6, with a view to determining the available replaceable hydrogen per gram of bone dry resin (dried to constant weight at 102° C.-107° C. in an air oven) in the hydrogen form (to be written further as HP-6H).

The dark brown resin, -20/+60 mesh, was "conditioned" by three cycles of exhaustion ($NaCl$ 5%) and regeneration (HCl 5%) and finally the regenerated form HP-6H was air-dried and stored in a stoppered bottle. The ash was 0.0%. The moisture was determined by heating in an air-oven at 102° C.-107° C.) to a constant weight.

The results given below, estimated to be within $\pm 1\%$, give milliequivalents of available replaceable hydrogen per gram of bone-dry resin HP-6H by different methods:

A. (a) by pH-titration curves² in presence of $NaCl$, at pH 7, = 2.27, at pH 11, = 2.84.

(b) by determination of ash (as $BaSO_4$) in the barium salt³ of the resin HP-6H, = 2.28.

(c) by determination of limiting exchange with $BaCl_2$ solution³ = 2.20.

B. By passing a solution of $NaCl$ through the column of the resin and determining the acidity of the effluent,

(a) with $N/2 NaCl$ (pH of last 50 c.c. effluent. 2.8) = 2.15

(b) " $N/100$ " (" 1000 c.c. effluent, 3.0) = 2.15,

A detailed account will be published shortly elsewhere.

Nat. Chem. Lab. of India,
Poona 7,
June 6, 1951.

S. L. BAFNA.
H. A. SHAH.

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3. Heymann, E., and O'Donnell, I. J., *J. Colloid Sci.*, 1949, 4, 395.

PREPARATION OF ISO-MORELLIN

ISO-MORELLIN could be obtained only in 6% yield by the method of B. S. Rao¹ as modified by P. L. N. Rao and S. C. L. Verma.² It can be however prepared conveniently in about 50% yield by refluxing morellin in dry pyridine for 6 hours and crystallising the product from alcohol. It melts at 120-21° (B. S. Rao gives m.p. 116°); $[\alpha]_D^{25} = -555.9$ (c, 0.5125% in chloroform); semi-carbazone, a pale yellow product, decomposes at 192°.

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Dept. of Biochem., S. C. L. VERMA.
Ind. Inst. of Sc., D. V. KRISHNA MURTHY.
Bangalore,
July 30, 1951.

1. *J.C.S.*, 1937, 853.
2. *J. Sci. and Ind. Research*, 1951, August issue (in print).

FRIES REARRANGEMENT OF β -NAPHTHOL ESTERS

SEN AND BHATTACHARJ¹ have published a note on the rearrangement of various aliphatic esters of β -naphthol under the conditions of the Fries reaction. Similar work has also been going on in our laboratory² and in view of the above note, we think it necessary to publish some of our results.

The Fries migration of β -naphthol esters has been hardly studied except for the acetate.³ We have systematically investigated the Fries migration of α - and β -naphthyl acetate as well as benzoate under various conditions, but only the results of the migration of β -naphthyl acetate and benzoate are presented here.

β -Naphthyl acetate isomerises to 1-acetyl-2-naphthol under the conditions of the Fries reaction. Besides this main product, a small quantity of another ketone (m.p. 150°) has been isolated from the reaction mixture. If this migration is carried out in nitrobenzene as solvent, the ketonic product, m.p. 150°, is not obtained, while carbon disulphide did not effect the migration at all. Zinc chloride instead of alu-

minium chloride gives at 140-50° a ketone which has been identified to be 6-acetyl-2-naphthol.

The Fries migration of β -naphthyl benzoate has been studied for the first time and the product obtained in small yield has been identified to be 1-benzoyl-2-naphthol. Nitrobenzene as a solvent yields the same ketone in better yield. It is noteworthy that unlike the transformation of β -naphthyl acetate, the benzoate migration gives only one product.

We have also investigated the effect of various factors on the course of the above migration. A detailed paper on the Fries migration of both α - and β -naphthyl esters is being sent for publication elsewhere.

The M. R. Science Institute, N. M. SHAH.
Gujarat College, G. G. JOSHI.
Ahmedabad,
June 5, 1951.

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2. Shah and co-workers, *J. Indian C. S.*, 1946, 23, 199, 234; 1948, 25, 377; *et seq.*
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FRIES AND FRIEDEL-CRAFTS REACTIONS IN COUMARINS

IN continuation of the work on Fries reaction in coumarins,¹ the migration has now been studied in the case of esters of 6-hydroxy coumarins. Earlier Desai and Mavani² had observed that no transformation occurs with the acetyl and benzoyl esters of 6-hydroxy-4-methylcoumarin,² while 6-acetoxy-7-methylcoumarin smoothly undergoes this rearrangement.³

In the present case the observation of Desai and Mavani² on the failure of migration in the case of the esters of 6-hydroxy-4-methylcoumarin has been confirmed. Attempts to introduce acetyl or benzoyl group by the Friedel-Crafts method also met with failures. However, 6-acetoxy- and 6-benzoyloxy-coumarins easily underwent Fries transformation to furnish 5-acyl derivatives. Similar results were obtained on Friedel-Crafts acylation of 6-hydroxycoumarin with acetyl and benzoyl chlorides. As already stated by Desai and Mavani,³ this failure in the case of 4-methylcoumarin derivative may be due to the steric effect of the 4-methyl group.

Negative results were also obtained on attempting rearrangement of acetyl and benzoyl esters of methyl 5-hydroxy-4-methylcoumarin-6-carboxylate and methyl 7-hydroxy-4-methylcoumarin-6-carboxylate. Friedel-Crafts reaction with acetyl and benzoyl chlorides on these coumarins were also unsuccessful.* Similar

unsuccessful results in the Fries rearrangement of the esters of 3-acetyl or 3-carboethoxy-7-hydroxycoumarin have been obtained by Shah and Shah.⁴ This inhibitive effect may be the result of decrease in general electron availability in the molecule due to the presence of acetyl or carboxylic ester group.

In 6-hydroxycoumarin series, the work is being extended with a view to have more evidence on the bond structure of coumarin derivatives.⁵ It was observed that 6-hydroxy-7-methylcoumarin easily coupled with benzene diazonium chloride,[†] which would be expected considering the easy coupling of 6-hydroxy-4-methylcoumarin already observed.²

The work on diazo-coupling, Fries transformation and Claisen rearrangement in 6-hydroxycoumarins, with either 5- or 7-position occupied by an alkyl group, is in progress.

Organic Chemistry Lab.,
The Institute of Science, V. M. THAKOR.
Bombay,
June 27, 1951.

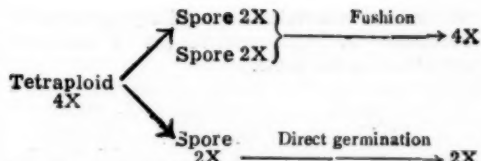
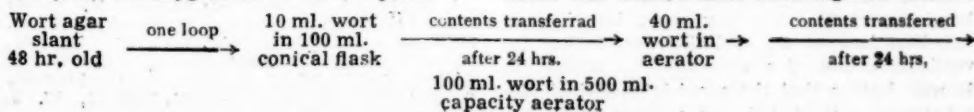
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* Under Prof. R. C. Shah. † With R. N. Usgaonkar.

AUTOTETRAPLOIDY AND THE SO-CALLED INBREEDING DEGENERATION IN YEASTS

EVIDENCE for the existence of polyploidy in yeasts was offered from two angles. Using a two chromosome brewery yeast, a doubling of the chromosome complement was demonstrated cytologically after treatment with acenaphthene.¹ Later, it was possible to recover the diploid from the autotetraploid by culturing in a medium containing 16% alcohol.² This has enabled a rational interpretation of the so-called inbreeding degeneration claimed by Winge and Laustsen.³

If we assume (1) that the control strain of Winge and Laustsen is a tetraploid and (2) that there is no direct diploidization,² then their supposedly heterozygous culture is a tetraploid, while the homozygous strain is a diploid:



Support for such a probability is offered by Roman, Hawthorne and Douglas.⁴ Among sixty-four four-spored asci obtained from a cross between two clones of *Saccharomyces*, one exhibited an irregular ratio. They suggest that the spores from this ascus had a diploid constitution and that the cell from which the ascus arose may have been a tetraploid. These diploid spores gave rise by direct germination to clones the spores of which gave a 2 : 2 segregation. It is exactly this suggestion which was offered by Duraiswami and Subramaniam² to explain the so-called inbreeding degeneration observed by Winge and Laustsen.³

Winge and Laustsen claim that the lower yield of dry matter by the "homozygous" strain is the result of an inbreeding degeneration. If our interpretation is correct, then our autotetraploid and the diploid should yield different amounts of dry matter. Winge and Laustsen³ estimated the yields "at different times with varying duration of the experiments." The data presented by them is given below and the difference in yield has been calculated on a percentage basis.

Results of Winge and Laustsen (page 32) :

	mgm dry matter of yeast			
Heterozygous	52.0	66.0	69.6	67.6
Homozygous through nuclear fusion	34.6	48.0	57.8	56.0
Difference in mgm.	17.4	18.0	11.8	11.6
Culture No.	1	2	11	12
Heterozygous %	150.3	137.5	120.4	120.7
Homozygous				

It is found that the "heterozygous" strains yield dry matter about 20 to 50% more than the "homozygous" ones.

In our investigations, the diploid and the autotetraploid strains were propagated under conditions of vigorous aeration adopting the schedule indicated below.

The yeast crop obtained at the end of 24 hours was washed after centrifugation and the

dry weight determined after keeping at 90° C. overnight. A representative set of results is presented in the table.

Strain	Total yield (Dry weight)	% Difference in yield (BY 3/BY 1)
Diploid (BY 1)	0.714 g.	..
Autotetraploid (BY 3)	1.252 g.	75.3

There is a striking similarity in the two results indicating that the phenomenon of inbreeding degeneration is not implicated at all and that the homozygous strain of Winge and Laustsen³ may be a diploid originating by the direct germination of a spore having a balanced chromosome complement.

We are very thankful to the Council of Scientific and Industrial Research for generous financial assistance.

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Cytogen. Laboratory, K. K. MITRA.
Dept. of Biochemistry, M. K. SUBRAMANIAM.
Indian Institute of Science,
Bangalore. July 2, 1951.

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COMMENTS ON THE ABOVE NOTE

THE opinion advanced by Duraiswami, Mitra and Subramaniam in the above note has already been set forth earlier by Duraiswami and Subramaniam, 1950, and I (Winge, 1951) have criticized their statement and several other peculiar hypotheses, advanced by Subramaniam and his collaborators.

As to the existence of polyploidy in yeasts I have never denied this possibility, and the observations by Roman, Hawthorne and Douglas (1951) seem distinctly to prove that they had in their material one tetraploid ascus out of a total of 64 giving four diploid spores. In each of the four single spore cultures they found spore formation and a regular Mendelian segregation from the asci of these single spore cultures.

Duraiswami and Subramaniam, on the other hand, have not made any spore isolations or hybridizations at all, and their cytological investigations are of a very doubtful nature. It is well known that there exists a distinct disagreement among different authors as to the

yeast chromosomes. It is extremely doubtful whether the bodies regarded by the Indian authors as chromosomes are chromosomes at all, as they are found scattered in the cytoplasm at all stages and in a varying number.

When now, once again, these authors attempt to prove that the yeast (Danish baking yeast) studied by us (Winge and Laustsen, 1940) was tetraploid and not diploid they apparently forget

(1) that our yeast has been shown to form regular 4-spored asci, and that the single spore cultures from these asci are (after diploidization) homozygous and constant (Winge and Laustsen, 1937). They are not *heterozygous* and do not segregate in the next generation as do the single spore cultures from the above-named ascus described by Roman, Hawthorne and Douglas.

(2) that we have demonstrated by direct observation that the spores of our baking yeast germinate in two different ways, some giving spherical, haploid cells, which must conjugate pairwise before they are able to form spores, and some giving directly diploid elongated cells, because the spores are or have become binucleate (Winge and Laustsen, 1937).

(3) that we have observed an inbreeding degeneration, however less pronounced, also when a diploid single spore culture arises through cell fusion (Winge and Laustsen, 1940, Table V).

(4) that our baking yeast has been crossed to other *Saccharomyces cerevisiae* types, giving normal fertile hybrids which sporulated normally. The spores from the hybrids germinated well, from 59% to 94%, giving normal, viable cultures (Winge and Laustsen, 1939).

This proves that our baking yeast is diploid and not a tetraploid variety, as Subramaniam and his collaborators so emphatically seem to maintain, without having made any experiments with our yeast at all.

Hence it is inadequate to assert that the decreased vigour we have observed in the offspring of the Danish baking yeast may be explained through a transition from a tetraploid to a diploid stage.

Carlsberg Laboratorium,
Copenhagen, Denmark,
August 18, 1951.

Ö. WINGE.

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AN IN VITRO EVALUATION OF THE TUBERCULOSTATIC PROPERTIES OF SOME SULFONE DERIVATIVES

SINCE the early reports of Rist, *et al.*,¹ of the tuberculostatic properties of 4-4'-Diamino diphenyl sulfone both *in vitro* and in experimental animals, its efficacy has been confirmed but all reports emphasize its appreciable toxicity. Attempts made so far to develop sulfone derivatives of lower toxicity and greater efficiency than the parent substance have not been very encouraging.² The present study gives an account of the *in vitro* activity of the compounds against Myco. tuberculosis prior to their evaluation in experimental Murine tuberculosis.

The first series of compounds are the biguanido derivatives of diaryl sulfones and in the second group are the mono and bis thio-carbamido derivatives. Their chemistry has been published separately.

The experimental procedures were similar to those adopted for testing the tuberculostatic properties of antimalarial compounds.³ The simple synthetic media as defined by Youmans⁴ was the media of choice and the D₁₃ strain of Myco. tuberculosis isolated locally from a case of pulmonary tuberculosis using the trisodium phosphate technique⁵ was the test organism. Propylene glycol was used as a solvent for the water-insoluble compounds. The results were read at the end of 4 weeks and recorded as shown in Tables I and II.

TABLE I

Tuberculostatic properties of some biguanido derivatives of sulphones

(R-NH-C-NH-C-NH-C ₆ H ₄) ₂ SO ₂		Drug concentration µg/c.c.						
R	NH	NH						
			100	10	5	2.5	1	0
1 C ₆ H ₅ -	-	-	+	2+	2+	2+
2 P-Cl-C ₆ H ₄ -	-	-	-	±	1+	2+
3 P-Br-C ₆ H ₄ -	-	-	-	-	1+	2+
4 PI-C ₆ H ₄ -	-	-	-	-	2+	2+
5 P-CH ₃ -C ₆ H ₄ -	1+	1+	2+	2+	2+	2+
6 P-CH ₃ O-C ₆ H ₄ -	-	-	-	-	+	2+
7 D.D.S.	-	-	±	1+	1+	2+

Legend: - No growth, ± faint growth, 1+ to 2+ various grades of growth.

The table indicates that compounds No. 3, 4 and 6 definitely show an increased activity over the parent D.D.S. and other bis-biguanido

derivatives. While compound No. 5 seems to have lost its activity by the substitution.

TABLE II

Tuberculostatic activity of mono and bis-thio carbamido derivatives of sulfones.⁷

(R-NH-CS-NH-C ₆ H ₄) ₂ SO ₂		Drug concentration µg/c.c.						
R								
		100	10	5	2.5	1	0	
8 C ₆ H ₅ -	..	-	-	±	1+	2+	2+	
9 P-BrC ₆ H ₄ -	..	-	-	-	+	2+	2+	
10 P-IO C ₆ H ₄ -	..	-	-	-	-	±	2+	
11 Allyl-	..	-	-	+	2+	2+	2+	

Compound No. 10-4-4'-(Di-iodophenyl thio-urea) amino diphenyl sulfonate, exhibits a markedly increased activity almost comparable to the inhibitory action of P.A.S. on this strain of Myco. tuberculosis.

The compounds were synthesised at the Organic Chemistry Department of the Indian Institute of Science, Bangalore. Our thanks are due to Prof. Guha and Dr. S. C. Bhattacharyya for kindly offering the compounds. We acknowledge with pleasure the help given by Dr. N. N. De and Dr. K. P. Menon during the course of the investigations.

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and Organic Chemistry B. N. JAYASINHA.
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Indian Institute of Science,
Bangalore 3.

July 13, 1951.

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ACTIVE RELAXATION OF UNSTRIATED MUSCLE^{1,2,3,4,5,6} FROM MARINE ANIMALS

A CONVINCING example of active relaxation in unstriated muscle has been found in the retractor of the introvert of the marine worm *Golfingia* (*Phascolopsis*) *gouldii* (Pourtales). The four retractors are removed along with the brain and immersed unloaded in sea water contained in a petri dish. The brain is stimulated

by slight pressure with a forceps. This results in contraction and subsequent active relaxation of the muscles. In over 20 experiments, they relaxed by 100 to 200 p.c. of their length during contraction. In sodium cyanide (1 in 10,000), the muscles contract but active relaxation is absent. Microscopically, the muscles consist of longitudinal bundles of fibres.⁹

In *Mytilus* muscle, no active relaxation has been found. There is a difference in the contractile mechanisms of the above two muscles. In *Mytilus* muscle, barium chloride and sodium cyanide cause contraction of the contractile mechanism;^{7,8} in the muscle from the worm, these chemicals do not cause such marked contraction, but rather relaxation, more in sodium cyanide than in barium chloride. This muscle, therefore, in some respects resembles frog's and mammalian muscle, in which there is active relaxation.

Marine Biological Lab., Inderjit Singh.
Woods Hole,
July 27, 1951.

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INTERACTION OF TEMPERATURE AND DAYLENGTH ON FLOWERING IN WINTER PADDY, RUPSAIL

TABLES I and II show that after-sowing temperature conditions markedly influence the growth characters and the degree of earliness due to photoperiods. In September sowing, the ear emergence is extremely uneven,

the flowering duration of individual plants of the 6 weeks' short-day treatment varying between 67-189 days, with a large number flowering at intermediate dates. Tillers of individual plants flowered after long intervals, the panicles being shorter and spikelets fewer than those in the February sowing. On the other hand, in the February sowing, temperature had gradually increased and consequently flowering was more uniform and finished within 62-76 days.

It was noted that there was no grain setting in the main shoot or the tillers of the control and the treated plants which flowered at the temperature range below 83°-61°, but some of the tillers of the same plant flowering in March (temperature range above 89°-63°) had normal grain formation. This difference in the setting of grains leads one to conclude that after anthesis, a critical temperature (nearly 90° F.) is necessary for the formation of grains. Similar results were obtained by Went¹ with cultivated tomato fruits and Kondo and Okamura² with some Japanese varieties of rice.

TABLE I
Effect of photoperiods on the growth of a
Winter Paddy, var. Rupsail in two sowings

		Average height in cm. after the end of the short day treatment	Number of tillers produced in plants 20 weeks old	Number of leaves produced before ear emergence
September sowing :				
Treated	..	21.75	6.0	9.7
Control	..	26.23	3.2	13 to 16
February sowing				
Treated	..	49.23	18.4	10.1
Control	..	47.85	8.5	20

TABLE II
Effect of after-sowing temperature conditions on the flowering behaviour of Winter
Paddy var Rupsail, treated with 8 hrs. short photoperiods for 6 weeks in two sowings.*

Sowing time	After sowing temperature conditions	Av. No. of days from sowing to ear emergence			Flowering duration in main shoot	Length of panicle		No. of spikelets in the panicle	
		Main shoot	1st tiller	2nd tiller		M St.	Till.	M St.	Till.
21st Sept. 1947	.. Decreasing from a max. of 92°·9 F. and a min. of 81°·4.	82.0	108.5	153.8	67-189	8.8	10	13	19.4
25th Feb. 1948	.. Increasing from a max. of 90°·8 F. and a min. of 66°·8 F.	69.2	97.3	106.3	62-76	9.6	12.7	19.3	24.3

* The control plants of the September sowing flowered 135.6 days after sowing. Those in the February sowing flowered after 250 days.

A comparison of the ear emergence data of the two sowings throws some light on the flowering behaviour of this variety of *Aman* paddy. In the present and earlier investigations, it was seen that irrespective of the time of sowing, plants flower at about the same time, i.e., November 7, on which date the day length is 11 hrs. 13 mins. and this may be taken as the critical photoperiod of this variety. In Calcutta (Lat. 22° 35' N.), this comes again on Feb. 5 after reaching a minimum of 10 hrs. 45 mins. on Dec. 22-25. If Garner and Allard's hypothesis³ holds good, this variety should have another flowering time about this time. The control plants of the September sowing (none of which flowered in early November, probably due to short vegetative period after sowing winter conditions) were subjected to natural short photoperiods, and the induction was extremely uneven due to prevailing low temperature, but the average number of days from sowing to ear emergence was 137 (reaching up to February 5). Thus Winter, *Aman*, varieties are fixed for a particular daylength and not a particular time of the year, as is usually known. While length of day is the primary external factor responsible for flowering, variations are chiefly due to the differences in temperature.

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S. M. SIRCAR.
S. P. SEN.

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AN ANTHRACNOSE DISEASE OF SPINACH

A SEVERE anthracnose disease of spinach (*Spinacia oleracea* L.) was observed in the Botanical Garden of Agricultural College, Kanpur, during 1947. A preliminary survey revealed that this disease also causes considerable damage to the crop in the neighbouring villages of Kanpur and other parts of Uttar Pradesh. It appears from the middle of January and gradually increases upto the harvesting season of the crop. The disease was first reported in 1890 by Ellis and Halsted¹ in New Jersey (New York) on spinach leaves and later by Petri,² Poeteren³ and Schultz⁴ on leaves, petioles and seeds. In India, this is the first record of the disease. The causal organism of the disease is *Colletotrichum spinaciae* Ell. and Halst. hitherto unrecorded from India,

The disease first appears on the leaves of spinach as minute, small, inconspicuous, yellowish, transparent spots which are usually circular, moist and water-soaked in appearance which later on become larger and develop a brownish rim. These lesions are about 2 to 4 mm. in diameter with slightly raised borders, but when two or more spots coalesce they become irregular in shape, the largest being an inch in diameter. Spots are generally seen at the margin of the leaf, being often elongated towards the midrib. The main nerves of the leaf limit the spread of the spot in certain directions. Then minute brown pustules appear upon either side of the leaf in five to seven days after the first indication of the blotch.

The symptoms on the stem appear at a later stage when the crown leaves have been removed giving rise to central shoot in plants left for seeds. The discolouration of the surface and the production of the water-soaked areas are the first indication of the disease on the stem near or above the ground level. Reddish brown areas are also formed which become dark brown as the disease advances. The central portion of the spot turns ashy white and shows the presence of acervuli.

The floral axis does not develop typical symptoms. The seeds are thickly covered with acervuli and become slightly black in appearance.

Usually the affected portions dry up and are studded with numerous dark dot-like acervuli which later on project outwards and become more prominent and slightly shrivelled. The disease, being of destructive nature, spreads rapidly from plant to plant of various ages, forming patches on all parts of the plant except the roots; ultimately resulting in the death of the plant.

Microscopic examination of the spots shows the presence of colourless, septate, branched hyphae. These are both inter and intracellular and ramify within the host tissues. Hyphae become shining brown at a later stage and measure from 1.6-4.6 μ with an average of 3.1 μ . Afterwards the mycelium collects into an entangled mass of hyphae below the surface of the cuticle. Due to the development of stroma, the cuticle is ruptured and the acervuli bearing conidia, conidiophores, and setae become visible on the surface. The colour of the acervuli is dark brown and changes to black. These are seen on the surface of the infected portions of the plant as small black dot like structures by the naked eye. When mature they are circular or oval, varying greatly in diameter and measure from 69-162 \times 54-102.2 μ .

Setae or bristles are long, dark brown, thick walled, septate, unbranched, tapering towards the end and broader at the base. The tips are lighter in colour than the rest of the setae. They measure from $54.4-154 \times 3.6-6.6 \mu$. Conidiophores are short, colourless, hyaline, continuous, are short, colourless, hyaline, continuous, simple, erect and are in crowded layers. These are single-celled, unbranched, packed together, broader at the base and tapering, slightly rounded at the tip. They measure $13.2-23.1 \times 1.8-3.5 \mu$. Conidia are hyaline, but appear slimy whitish pink in mass and are borne singly at the end of the conidiophores or may fall off. They are single-celled, sickle shaped (curved) and are filled with thick granulated protoplasm in the younger stage. Later they contain two or three oil globules and measure $13.2-28.8 \times 2.8-4.2 \mu$. The chlamydospores and appressoria have been observed in artificial cultures. Chlamydospore may be completely round or elongated, surrounded by a thick membrane and measure $6.48-21.6 \mu$ in diameter with an average of 13.8μ . Appressoria are slightly round or pear shaped varying in shape and size.

The pathogenicity of the isolates has been tested by various inoculation experiments under artificial and natural conditions and the fungus proved to be pathogenic. Symptoms identical to those caused by *Colletotrichum spinaciae* on spinach are produced after six to ten days. Re-isolations from these artificially inoculated diseased materials produced cultures identical to the original ones.

Botany Section, BABU SINGH.
Govt. Agricultural College, VIPIN C. GUPTA.
Kanpur,
April 24, 1951.

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AUTOCATALYTIC CURVE DURING NITRITE FORMATION

It is well known that during nitrification, the graph of nitrate accumulation against time follows an 'S'-shaped path, characteristic of many physiological processes. This was first demonstrated by Lees and Quastel² by means of their soil-perfusion technique. Later, Martin³ using the value of K was able to classify some grassland soils. These investigations indirectly

favoured the biochemical theory of soil nitrification.

Since nitrite formation is part of nitrification and as such curves had not been demonstrated previously in tropical soils, we set out to plot the values of Nitrite accumulation against time, of two local soils. Secondly, it was also attempted to find out if the value of K, as judged from above, could enable us to arrive at some conclusions regarding 'soil fertility'.

Soils were selected from the roots of two plant associations, namely, *Amaranthus spinosus* which indicates a high nitrifying capacity, together with a high degree of nitrophily,¹ and *Eleusine indica* showing low nitrifying capacity and growing in unfertile habitat.⁴

These soils were distributed in a set of 20 flasks, each of which contained 20 c.c. of sterilised Omeliansky's culture solution with 1 c.c. of 5% ammonium sulphate solution. The temperature, light (the experiments were performed in the dark), and relative amount of soil to solution were the same for both the soils. The nitrite-nitrogen obtained during the process was measured as p.p.m. by the Griess-Llosway colorimetric method.

When the values for nitrite accumulation were plotted against time, an almost perfect 'S'-shaped curve was obtained which, unlike the nitrate curve² precipitated swiftly downwards after achieving the peak. This is due to rapid transformation of nitrite-nitrogen to nitrate-nitrogen after a certain 'threshold' value.

The equation for the curve as given by Quastel² is:

$$\log y/(A-y) = K(t-t_m),$$

where y is the amount of nitrite accumulated in time t ; A the initial quantity of nitrogen subjected to transformation and K the "Rate Constant"; t_m is the time taken for half completion of the process and represents the point when the rate of conversion of ammonia is the fastest.

In the present experiment, the value of A has been taken as equal to the maximum value of y during the process. In case of *Amaranthus* soil, the value of A has exceeded the theoretical value (530 p.p.m. of nitrogen as calculated from the amount of ammonical nitrogen initially supplied); the excess of nitrogen found over that added must have arisen from the nitrification of soil ammonia.³ From the day-to-day values of nitrite-nitrogen, the graph of $\log y/(A-y)$ against time t was also plotted which gave straight lines for both the soils. (Fig. 2).

The following table shows the results given by the two soils:

(i) <i>Amaranthus spinosus</i> soil			(ii) <i>Eleusine indica</i> soil		
Time in days 't'	Accumulated Nitrite N in p.p.m.	$\log \frac{y}{A-y}$	Time in days 't'	Accumulated Nitrite N in p.p.m.	$\log \frac{y}{A-y}$
2	15	-1.55	6	55	-0.93
4	56	-0.95	11	125	-0.52
7	100	-0.65	14	220	-0.15
9	198	-0.25	17	310	+0.15
12	380	+0.35	19	400	+0.49
14	500	+1.0	21	460	+0.72
16	550	..	23	480	+0.98
18	410	..	26	505	..
21	Nil	..	28	295	..
			30	Nil	..

From these results, graphs showing the accumulated nitrite-nitrogen against time (Fig. 1), and

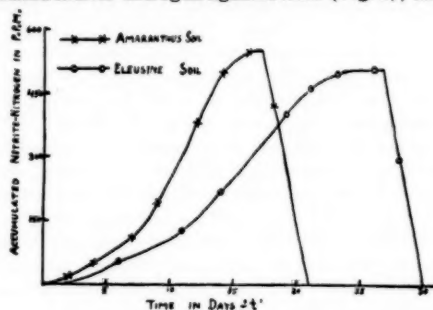


FIG. 1

the regression of $\log y/(A-y)$ on t are plotted. From the slopes of the straight lines obtained in Fig. 2, the rate constant, K , is calculated for the two soils.

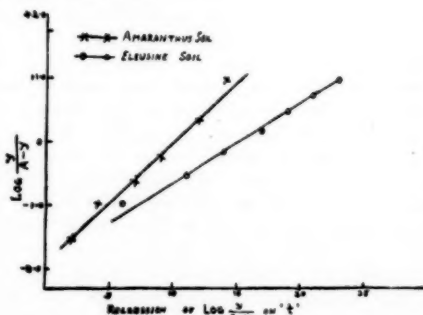


FIG. 2

K for *Amaranthus spinosus* soil = 0.193.
 K for *Eleusine indica* soil = 0.125.

From Fig. 1, it can be seen that the oxidation of ammonia to nitrites follows a typical 'S'-shaped curve as the regression on time also gives a straight line (Fig. 2). It could be seen from the graphs that the curve for the fertile soil (*Amaranthus*) shows a steeper course and requires a shorter duration to reach the peak than the infertile soil from *Eleusine*, and hence the oxidation in the former is faster than in the latter. The rate constants, K , also vary with the nature of the soil, i.e., in the fertile soil the oxidation of ammonia being speedier, the value of K is higher than in the fallow unfertile soil. Hence, on the basis of the differences in the "rate constants", we are able to grade the various types of soils.

Thus, our investigations have shown that the oxidation of ammonia to nitrites also shows the "autocatalytic curve" which indirectly proves the biological nature of oxidation.

Dept. of Botany,
The Inst. of Science,
Bombay 1,
May 1, 1951.

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P. J. DUBASH.
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A NOTE ON THE OCCURRENCE OF *TRIPHLEPS* SP. (ANTHOCORIDAE— RHYNCHOTA), A HITHERTO UNRECORDED PREDATOR OF STORED GRAIN PESTS IN INDIA

DURING the course of investigations on the biology and control of stored grain pest, the writer found several Anthocorid bugs in cultures of *Latheticusoryzæ*. The bug was identified by the Commonwealth Institute of Entomology, London, as *Triphleps* sp. It is a predator on stored pests and has been recorded for the first time in India. There are records of only a couple or so of the species of *Triphleps* in stored grains in the world. One of them, viz., *T. frumenti* is reported as "possibly predator on pests of imported grains in Germany" and the other, viz., *T. madeirensis*¹ is reported in stored grains in Egypt. After comparing the descriptions of the predators mentioned above with the one found, it was observed that the present species differs markedly from the above two. The detailed studies on the biology of the predator has been completed at the Entomological Laboratory, I.A.R.I., New Delhi,

at room temperature during the months of March-April-May. The adult bug is dark brown or black in colour and measures about 1.7 to 2.2 mm. in length and about .7 to nearly 1 mm. in breadth. The wings are very short. There is a slight variation of size in the two sexes. The preoviposition period was found to be 2-4 days. The number of eggs laid varied from 2-9 eggs per female per day depending on the quantity of food available. The incubation period varied within 4-5 days. The 1st, 2nd, 3rd, 4th and 5th stages lasted for 2-4 days, 2-3 days, 2-4 days, 2-3 days and 3-5 days respectively. There are altogether 5 moults. The nymphs were found to predate at the rate of one grub a day. The adults though generally predated on one grub only were sometimes found to predate on two grubs on the same day. This was specially so in the case of *O. surinamensis* where even three younger grubs were fed upon in one day. The mode of feeding was also studied. The nymphs, specially the younger ones, prefer younger grubs of the hosts. The bug was found also to predate on the grubs that had freshly pupated. It was also found to predate on younger stages of *Corcyra cephalonica* but preferred the grubs of *L. oryzae* and *O. surinamensis*.

There can be little doubt that the predator plays an important role in keeping down the pests infestation in the stored cereals. Further work is in progress.

Ind. Agric. Res. Inst., SNEHAMOY CHATTERJI.
New Delhi,
May 18, 1951.

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ADAPTATION OF FUNGI TO FUNGICIDES AND ITS SIGNIFICANCE IN AGRICULTURE

REFERRING to the adaptability of fungi to increasing concentrations of toxic substances, Stakman, Stevenson and Wilson¹ stated that haploid lines of corn smut showed a definite increase in tolerance to arsenic in the media if they were grown on a series of ever increasing concentration of sodium arsenite. This tolerance or ability to grow in the presence of arsenic could be raised to a considerable degree over that of any line not having had such treatment. Gattani² showed that diploid lines of corn smut like their haploid parents developed the ability to grow on media containing approximately six times the concentration of sodium arsenite as the lines would tolerate initially. Christensen

showed that mononidial isolate of *Giberella zeae* developed increased tolerance to malachite green, mercuric chloride and ethyl mercuric phosphate. From these investigations it would appear that if fungi could adapt themselves to increasing concentrations of toxic chemicals, our attempts to control plant disease by a given chemical agent would defeat its own purpose.

The author has been carrying out investigations since 1944 to find a solution to this problem. During the course of these, single spore isolations of *Alternaria* sp. associated with wheat seeds were made and the fungus grown on potato dextrose agar (PDA) containing increasing concentrations of Agrosan GN, (fungicide with an organic mercuric compound as the active ingredient). When the fungus was transferred directly from potato dextrose agar to PDA containing increasing concentrations of Agrosan GN, it could grow only on media containing upto 300 p.p.m. of Agorsan GN in PDA. From lower to higher concentration there was a gradual decrease in the size of the colony. However, on being successively transferred during five transfer generations from lower concentrations to higher concentrations of Agorsan GN, the fungus could be made to grow on PDA containing 700 p.p.m. of the fungicide.

Next the fungus was grown on potato dextrose agar containing different concentrations of Arasan. (50 per cent. Tetra methyl thiuram disulfide). The unadapted line could only grow on PDA containing upto 700 p.p.m. of Arasan. When the fungus was transferred successively during seven transfer generations from media containing lower concentrations to higher concentrations, it could grow on PDA containing 2,000 p.p.m. of Arasan.

The next phase of the investigation was to study the behaviour of the line adapted to Arasan on the media containing increasing concentrations of Agrosan GN and the line adapted to Agrosan GN on the media containing increasing concentrations of Arasan. It was observed that the line which had been adapted to Arasan, when transferred to the Agrosan GN series behaved like an unadapted line as it could tolerate a concentration of 300 p.p.m. of Agrosan GN only. In the same way the line which had been adapted to Agrosan GN when transferred to the Arasan series behaved like an unadapted line as it could grow on PDA containing upto 700 p.p.m. of Arasan only.

These investigations thus provide a clue to the problem of adaptation of fungi to fungicides. When plants are sprayed or dusted with fungicides it is possible that the fungus may be exposed to the fungicide for a considerable

period, and may, therefore, adapt itself to that particular fungicide. Continuous use of that fungicide may prove ineffective for control of that disease. In the light of these investigations the obvious remedy in such a case would be to use another fungicide containing a chemically different active ingredient as a dust or spray reagent.

Fuller details will be published elsewhere.

The author is grateful to Prof. E. C. Stakman of the University of Minnesota, U.S.A., for many helpful suggestions.

Sec. of Plant Pathology, M. L. GATTANI.
Dept. of Agriculture,
Govt. of Rajasthan,
Bharatpur,
June 16, 1951.

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RUSTS ON WILD GRASSES

DURING 1948-49 there was a severe outbreak of rusts on the wheat crop in the farm attached to the Botany Division of this Institute and it was observed that 13 out of 59 wild grasses that were being grown in the neighbourhood of wheat plots were infected with rusts. Yellow

rusts *trinecilis*, infected wheat. Morphologically also all the collections were identical with black rust of wheat and so belong to *Puccinia graminis* var. *tritici*. Spores from *A. trinecilis* had lost their viability, so that no conclusions regarding the identity of this rust can at present be drawn. The relevant information regarding the grasses which were found infected is given in the table. The size of uredospores of black rust of wheat collected from the neighbouring plots is also provided for comparison.

Rusts from host Nos. 7, 9, 11 and 12 yielded races 21, 40 and 42 of *Puccinia graminis* *tritici*.

In view of the fact that black rust of wheat has been found to infect these grasses, all of which are exotics, it is very essential to test the reaction of the imported grasses to Indian physiologic races of wheat rusts under quarantine conditions prior to their release for general cultivation in this country, as these may act as collateral or alternative hosts of wheat rusts. Even annuals imported from temperate countries may be able to grow during summer in the hills and submontane regions where over-summering of rusts is frequent. Susceptible grasses, both annuals and perennials, would thus act as congenial alternative hosts for the multiplication of initial inoculum.

Div. of Myc. & Plant Path.,
Ind. Agric. Re. Inst., RAGHUBIR PRASADA.
New Delhi,
July 9, 1951.

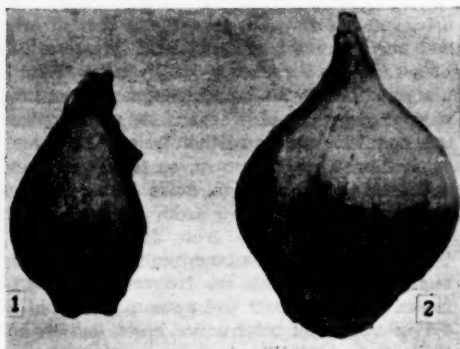
Name of host		Source	Size of uredospores in μ
1	<i>Bromus coloratus</i>	Uruguay	23.3-36.6 × 13.3-16.6
2	<i>Bromus carinatus</i>	Uruguay	23.3-36.6 × 13.3-16.6
3	<i>Bromus mollis</i>	U.S.A.	21.6-33.3 × 11.6-18.3
4	<i>Hordeum distichum</i>	Baluchistan	23.3-33.3 × 13.3-16.6
5	<i>Hordeum murinum</i>	Baluchistan	23.3-33.3 × 13.3-16.6
6	<i>H. stenodachys</i>	Uruguay	23.3-33.3 × 13.3-16.6
7	<i>Agropyron semicostatum</i>	China	19.9-33.3 × 13.3-16.6
8	<i>Lolium perenne</i>	Australia and Quetta	19.9-33.3 × 11.6-16.6
9	<i>Hilaria Jamesii</i>	U.S.A.	19.9-36.6 × 11.6-16.6
10	<i>Aegilops squarrosa</i>	Kew	23.3-36.6 × 13.3-16.6
11	<i>A. ventricosa</i>	Kew	23.3-36.6 × 13.3-16.6
12	<i>A. trinecilis</i>	Kew	23.3-36.6 × 13.3-16.6
Wheat (Local variety)			21.6-26.6 × 13.3-16.6

rust [*Puccinia glumarum* (Schm.) Erikss. & Henn.] was present only on *Phalaris minor*, whereas, all the rest were infected with black rust (*Puccinia graminis* Pers.). Yellow rust found on *Phalaris minor* failed to infect wheat and appears to belong to a different variety. Also, artificial inoculations of this grass with yellow rust from wheat were unsuccessful. Black rust found on other grasses, except *Aegi-*

BLACK MOULD OF ONIONS IN STORAGE CAUSED BY *ASPERGILLUS NIGER*

ONIONS are imported in large quantities into Bangalore from Rampur, Anantapur, Bellary and Gulbarga. The imported onions in storage frequently show black lines between the outermost dry scales, sometimes thin, sometimes

diffuse (see Fig.). These lines are in the region of the veins. On microscopic examination they are seen to consist of the conidiophores and conidia of a species of *Aspergillus* looking like *A. niger*. Mites are found feeding on the spores. Apart from the disease spreading by actual contact of sound with mouldy onions, the mites may serve to start the infection in a fresh consignment when it is stored in an infected godown. Hansen and Davey² have found that mites and thrips are responsible for transmission of *Aspergillus* spp. and other fungi in figs.



Black mould of Onions. Outer scale removed completely in 1 and partly in 2 to show the black lines.

Both the white and red varieties are attacked, the white being very susceptible. Ordinarily the damage in the godowns may be up to 5 per cent. of the bulbs, but under humid and ill-ventilated conditions it may reach 30 per cent. The rot is a dry one in the early stages, but later on, due to invasion of soft rot bacteria, a wet rot develops.

The fungus infection may start at the base of the bulb, and proceed to the neck, or may start at the neck and travel to the base.

The fungus was brought into pure culture by taking the spores aseptically on a platinum spatula, and planting them in a poured plate. Transfers from the edge of the resulting colonies gave a pure growth.

Inoculations were made in the laboratory using the white and red varieties of onions. Punctures were made on the bulbs with a sterile needle, small bits of a pure culture placed over the punctures, and the inoculated bulbs kept in a moist chamber. The white variety took the infection in two days, and was completely infected in a week to ten days. The infection on the red variety was confined to the points of inoculation and did not spread. The controls remained healthy. The fungus was re-

isolated from the inoculated onions, and was found to agree with the original isolation.

Infection by *A. niger* on onions has not been recorded before this in India, although it has been observed in U.S.A.,^{4,5} Canada³ and Australia¹ *Aspergillus* spp. have been known to cause rots and moulds in figs, dates, pomegranates, apples, citrus fruits, cotton bolls and mangoes. The fungus is a weak pathogene and its effects are apparent under stored conditions.

Lab. of Plant Path., S. V. VENKATARAMAN.
Dept. of Agriculture, M. H. DELVI.
Bangalore,
August 9, 1951.

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OZONIUM WILT DISEASE OF POTATO

Roor rot and wilting of potato plants incited by a soil-inhabiting fungus was observed in the Central Potato Research Institute, Patna, for the first time during the crop season of 1949-50. The disease was noticed again on the crop in the Institute in 1950-51. The affected plants first showed slight yellowing of the lower leaves, followed by sudden loss of turgidity and wilting of the entire plant within a few days. A brief survey has indicated that this disease may be widespread; it has so far been found to occur in the cultivators' crop in the Patna City and Bhowali (Uttar Pradesh) and in the crop at the Potato Breeding Sub-station at Simla. About one per cent. of the *Phulwa* plants in some cultivators' fields at Patna and up to three per cent. of the plants in the variety *Majestic* in restricted plots at Bhowali wilted due to infection by this fungus.

Examination of the underground portions of the diseased plants showed the presence of a delicate net work of rhizomorphs of the fungus branching fan-wise (Fig. 1). The stolons and roots were killed at first by the fungus which gradually spread and girdled the stem at the collar region. At this stage, the plant showed sudden wilting due to failure of translocation of water to the shoots above-ground. On the rhizomorphs, numerous orange-buff to brown sclerotia which were smooth, ovate to spherical in shape and measuring 1 to 3 mm. in diameter, were borne.

The fungus grows readily on artificial media developing strands of hyphae and numerous



FIG. 1. Showing the rhizomorph and the sclerotia produced on the plant $\times 1$, Nat. Size.

sclerotia which are larger in size and variable in shape than those produced on the plant (Fig. 2). Inoculation experiments using fungal strands and sclerotia produced in artificial cultures, brought about the wilting of potato plants (Darjeeling Red Round) within 20 days.

Comparative studies have indicated that the fungus is a species of *Ozonium* closely resembling *O. texanum* described by Neal¹ and Wester, as being saprophytic on dead cotton stalks and roots in Texas (U.S.A.). The species under study has the potentialities of a serious pathogen similar to *Phymatotrichum* (*Ozonium*) *omnivorum* (Shear) Duggar in inciting the wilting disease of several other hosts (Streets),² such as tomato, sun-hemp, etc., in addition to potato.

It is proposed to present the fungus under study as a new variety, with the name *Ozonium*

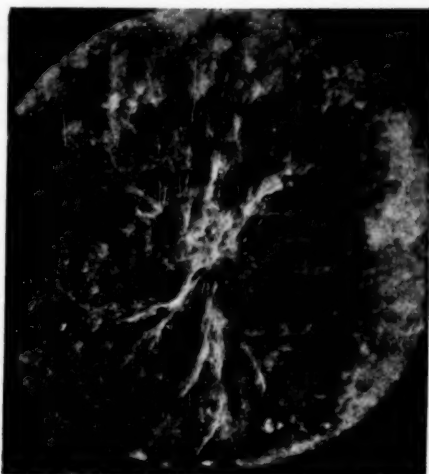


FIG. 2. Artificial culture of the fungus $\times \frac{1}{4}$, Nat. Size.

texanum Neal & Wester var. *parasiticum*. The aetiology of the fungus, the extent of its distribution and the damage it causes to the potato crop are under investigation.

Grateful thanks are due to Dr. S. Ramanujam, Director, Central Potato Research Institute, for valuable suggestions.

Central Potato Research

Institute,
Patna (Bihar).

August 1, 1951.

M. J. THIRUMALACHAR.

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SECOND INTERNATIONAL CONGRESS OF BIOCHEMISTRY

THE SECOND INTERNATIONAL CONGRESS OF BIOCHEMISTRY is to be held in Paris from the 21st to the 27th of July, 1952.

The programme has not yet been definitely decided on. Nevertheless, the Congress Committee has drawn up a plan for the study of biochemical questions of current interest during seven symposia:

(1) Biochemistry of Steroids. (2) Biochemistry of Haematopoiesis. (3) Biogenesis of the Proteins. (4) Tricarboxylic Acid Cycles. (5) Bacterial Metabolism. (6) Mechanism of action

of the Antibiotics. (7) Protein Hormones and Hormones derived from Proteins.

Communications dealing with other biochemical problems will be grouped together in appropriate sections.

Four general lectures will be given by well-known scientists.

Authors should send the titles of their communications before the 1st of March, 1952, and a summary of less than 200 words before the 1st of April, 1952, to the General Secretary, Professor J. E. Courtois, 4, Avenue de l'Observatoire, Paris VI°.

REVIEWS

Practical Mathematics, Part III. Geometry with applications. By Claude Irwin Palmer & Samuel Fletcher Bibb. (McGraw-Hill Book Co.), 1950. Pp. 200. Price \$2.20.

This book is the third in a series of four books in practical mathematics. It is intended for one who realizes that Mathematics is a powerful tool which he must be able to use in performing his work and who has no previous knowledge of the subject. The fruit of hundreds of years of labour in plane and solid geometry is presented in a simple and direct manner.

The subject is divided into nine chapters in the usual order and some of the chapters begin with interesting previews. The set of tables at the end of the book will be found very convenient and useful to all practical workers. Intuitive methods are used for establishing geometrical principles and facts.

The text deals with many applications under separate headings, such as brickwork, lumber, the steel square, screw threads, belt pulleys and gear wheels. Numerous interesting exercises representing up-to-date problems in various fields are included.

The book contains more than 200 beautiful diagrams. Printing and get-up are excellent. The book is written in a beautiful style and is sure to be a very useful handbook for a practical man.

S. N. M.

Basic Mathematical Analysis. By H. Glenn Ayre (Mc-Graw Hill Book Co.), 1950. Pp. 584. Price \$5.00.

As the title itself suggests, this book gives a descriptive and detailed exposition of the analysis of basic mathematics, beginning with the development of the number system, exponents and logarithms. These cover the first four chapters; the concept of functions, trigonometric functions and solution of triangles cover the next four chapters. Chapter Nine, where the notion of limit, and the derivative as measure of rate of change, are explained and Chapter Ten together cover approximately the Intermediate Syllabus in Differential Calculus of the Indian Universities. The remaining chapters deal with polynomial equations, conic sections, polar co-ordinates and "special curves", quadric surfaces, simple sequences and series and an introduction to the exponential function.

Every theoretical idea is illustrated graphically and interesting historical notes are inter-

persed in the chapters. Some of the defects like that of introducing the exponential function as $(e)^x$ without mentioning anything about irrational exponents, are in glaring contrast with the systematic development in the earlier chapters. It would have been more pleasant reading if examples and explanations of too elementary a nature were omitted.

It is neither sufficient nor necessary as a text-book at any stage. The book serves its purpose best as an interesting and desirable reading for students of Mathematics in general, and to the First Year Honours students of our Universities in particular, inspiring them with a desire to explore the wonderful kingdom of "The Queen of Sciences" and enabling them to develop the proper background for the rigour of more advanced courses.

S. N. M.

Creep of Metals. By L. Rotherham. (Institute of Physics Monograph), 1951. Pp. 80. Price 15sh. net.

A balanced picture is first presented of the mathematical law relating creep rate to stress, temperature and time, with special reference to the classical work of Andrade. Next, the mechanism of crystalline flow is discussed and the discrepancy between the theoretical and observed critical shear stress is explained by the modified dislocation theory of Taylor. The mechanism of creep deformation as observed in single, bi-, and poly-crystals is developed and the divergent theories of "slipless" flow of Hanson & Wheeler, the "cell" division of crystal grains of Wilms and Wood and the "polygonisation" of Lacombe & Beauvard are stated cogently. The ideas of Orowan, Mott and Nabarro are analysed to account for transient creep due to presence of dislocations; steady-state or viscous creep is explained by a similar mechanism operating in the grain boundaries and the adjoining crystal regions. Experimental evidence is adduced to show the intercrystalline cracking that generally precedes the last or tertiary stage of creep.

The monograph carries the authority of many years of research at the R.A.E., Farnborough. It is eminently suitable for the use of research workers and metallurgists who already are well acquainted with the background of the subject. The matter and style are crisp and the

book has an excellent bibliography. The Institute of Physics is rendering a service to industry by bringing out such publications.

Climate Near the Ground. By Prof. Dr. Rudolf Geiger. (Harvard University Press, Cambridge, Massachusetts). (Translated into English from German by Milroy N. Stewart and others). Price Rs. 25.

Prof. Dr. Rudolf Geiger is a world authority on the above subject. His classical book entitled *Das Klima der Bodennahen Luftschicht* has been revised twice and now a fourth edition is due. Meanwhile, here is an English translation of the second edition. Prof. Geiger's School of Micro-Climatology has been an inspiration to workers in this field for several decades now. The English version renders a most valuable service by making available to us the literature on this subject, which deals with the actual environment in which plant, animal as well as human communities live and grow.

The book is divided into 2 parts. The first part deals with the climate existing near the ground and is divided into 17 chapters. The complex subject of the heat balance near the ground which depends on various factors like solar radiation, albedo, radiative exchange in the infra-red region, conductive processes into the ground as well as convection upwards into the air through the medium of eddies and heat taken up for evaporation and that released during condensation of moisture; the special phenomena such as high lapse rates by day and strong inversions of temperature associated with nocturnal cooling, the diurnal variation of temperature and its variation with height; and humidity and wind relationships in which ground surface and air layers near the ground play an important part: all these are discussed in these several chapters in a most fascinating manner, leaving the reader with clear-cut and precise ideas on the subject at the end of even the most rapid perusal.

In Part II, Prof. Geiger deals with the effect of topography on the microclimate which profoundly influences the way in which the cold air manufactured by nocturnal radiation processes is redistributed very much like water collecting at the bottom of valleys. The influence of inclination of the ground to the vertical on the microclimate and the microclimates of caves and enclosed spaces are also dealt with. Later, we are led on in a logical manner to the influence of plant cover on microclimate. The way in which plant communities are influenced by climate and in turn influence the local climate, the effect of the various phytophases

on the variation of microclimate during the course of the year, etc., are also discussed. Chapters 36 to 41 deal with the relation of animate creatures and man to the microclimate, an important branch of bioclimatology. As mentioned already, the discussion throughout is based on fundamentals and the author spares no pains to show how simple the various complex phenomena really are and how every aspect of bioclimatology finds simple explanation on the basis of the fundamental laws of physics. During the last 20 years the author and the present reviewer have been in close contact with each other's work and it is indeed a pleasure to note that the work we have been developing in India on the subject of microclimatology finds very frequent reference in the course of the book which contains many reproductions of diagrams from the Indian publications. There is also a well arranged bibliography at the end of the book.

This most important publication of the year on climate of the air layers near the ground should make a very profound appeal to physicists, biologists, meteorologists, botanists and foresters as well as to those engaged in medical and house building research. We warmly recommend it to scientists in India. The price is modest and we hope a copy of it will soon be in the library of every research institute and university in India.

L. A. R.

The Growth of Physical Science. By Sir James Jeans. Second Edition. (Cambridge University Press), 1951. Pp. x + 358. Price 15 sh.

The second edition is practically the same as the first which came out in 1947, except that some corrections have been made regarding citations, dates and such minor details. Jeans has the rare gift of lucid exposition; combined with a careful selection of the material, the book has become an eminently readable account of the history of physical sciences. To the eager reader, there is sustained interest from beginning till end and this is further enhanced by the introduction of humorous anecdotes regarding the lives of the scientists.

Nearly a third of the book is devoted to the scientific achievements of Babylonia, Greece and Egypt, which is followed by a brief section about the so-called dark ages, leading up to the birth of the "renaissance". The rest of the book gives a bird's-eye-view of modern science, mainly through short biographical sketches of the prominent men of science in each era.

Thus the book essentially deals with the progress of science in Europe and the Middle East,

As Jeans himself says, "India and China contributed to Western science only through the intermediary of the near east, so that we shall not go far wrong if we disregard these remoter Eastern civilizations and confine our attention to the nearer which formed direct stepping-stones into Europe." However, he does touch upon the contributions of these countries in exceptional cases, e.g., he says, "the Indian mathematician Bhaskara (born in 1114), wrote an astronomy which contains the first known explanation of our present-day method of addition, subtraction, multiplication and division."

The book is moderately priced and the printing and get-up are excellent. It should find a place in every library, both scientific as well as non-scientific.

Fourier Transforms. By I. N. Sneddon, (McGraw Hill Book Co.), 1951. Pp. 542.

This book, which forms the third in the International Series of Pure and Applied Mathematics, does justice to the title of the series in that it deals adequately with both purely mathematical aspects of Fourier transforms as well as their applications to mechanics and physics. It is intended for those who have had a fairly good grounding in mathematics, but no specialised knowledge of any branch of physics is assumed. The first three chapters deal with the basic mathematical theorems in Fourier transform theory. Unlike some other books in this field, which restrict themselves to a special type of transform, such as the Laplace or the Mellin transform, here the whole field is briefly surveyed—Fourier's integral theorem, Laplace transform, Mellin transform, Hankel transforms and finite transforms, both of the Fourier and Hankel types. These chapters are written in such a manner that a student not interested in the details of the proofs may readily pick up the results he needs.

The rest of the book of nearly 450 pages, contain details of the numerous applications of theory and it is in this that the book under review makes a notable departure from the conventional mathematical treatises. The examples chosen are not just those which nicely illustrate points of theory, but rather those which one practically meets with and in which the theoretical method has to be suitably modified. Most of the examples are taken from research papers written in the last ten years. They cover a wide field—theory of vibrations, conduction of heat, two-dimensional and axially symmetrical stress distributions, hydrodynamics, atomic and nuclear physics and the slowing down of neutrons in matter, for which the

equations closely resemble those of heat conduction.

The book would be best appreciated by research workers, rather by those who are starting on research, as it very ably expounds the technique of working out various problems.

G. N. R.

Chemical Activities of Fungi. By Jackson W. Forster. (Academic Press Inc., New York), 1949. Pp. xviii + 648. Price \$9.50.

The subject of fungi, first developed by mycologists as a part of systematic and morphological botany, attained chemical and physiological significance when it was discovered that some of them cause disease among animals and plants while others could produce a bewildering variety of chemicals—acids, solvents, vitamins, enzymes and antibiotics. The successful production of some of these chemicals on an industrial scale has greatly stimulated a further systematic and intensive study of the metabolism of these widely distributed and industrially important organisms.

When the distinguished author commenced his graduate apprenticeship in 1936 under the inspiring guidance of Professor Waksman, he was bewildered at the "unavailability of a suitable treatise comprehensive enough to orientate a non-specialist in this field." Although a tremendous amount of useful and suggestive work had already been carried out it was, at the time, found widely scattered in scientific literature. The author felt the need for "an authoritative, critical book, integrating and evaluating the field" and "was presumptuous enough to tell Dr. Waksman that he ought to write such a volume". Dr. Waksman's counter-suggestion that he should work for 5 years and write it himself, has apparently inspired the production of this excellent treatise on the Chemical Activities of Fungi.

In a series of 19 chapters, the author has broadly covered the field of fungal biochemistry both in its academic and technological aspects. The second chapter on the methodology of mold metabolism will be found extremely useful to every worker in biochemistry seeking guidance on the technique of handling molds for research. The fifth chapter on natural variations deals with an important aspect of fungi which reminds the uninitiated investigator about the instability, mutability and the "treacherous" character of these organisms.

Improvement of strains of industrially important fungi through artificially induced mutations to day constitutes an accepted method of enhancing or side-tracking or controlling the

chemical activities of fungi, and of raising the yield of their products to economically competitive levels. Penicillin production owes its spectacular success to the development of high yielding mutants of *Penicillium chrysogenum*. The technique of inducing such mutations and the genetic and the biochemical mechanisms operative in such mutants, are described in the sixth chapter.

The seventh chapter is concerned with the trace elements which profoundly influence the course of biochemical reactions in fungi. The succeeding chapter deals with the formation and metabolism of alcohol and some important di- and tri-carboxylic acids. Itaconic acid which has attained great significance in industry on account of its employment in the production of methacrylic acid has received special attention (Chapter 13). The last chapter is devoted to the microbiological aspects of penicillin which contains a revealing and historical account of its development in the United States. In this review, it has been possible for us to invite attention to only a few of the important highlights of this volume which will be gratefully welcomed by all investigators interested in the fields of Comparative Biochemistry and Fermentation Technology.

Technique of Organic Chemistry. Vol. V. Adsorption and Chromatography. By H. G. Cassidy. (Interscience Publishers, New York), 1951. Pp. xix + 360. Price \$ 7.00.

The first book on the Principles and Practice of Chromatography (Zechmeister and Chohnoky) appeared in 1941, followed a year later by Strain's book on Chromatographic Adsorption Analysis. The papers published on chromatography during the last ten years run into many hundreds, and since 1949 Strain has been making an annual review of chromatography in Analytical Chemistry. The New York Academy of Sciences, the Faraday Society and the Biochemical Society have held symposia on the subject. However, this book represents the first attempt "to describe and explain, by discussion of principles, the various methods by which adsorption may be utilized in organic chemistry as a tool for the separation of mixtures."

Since theoretical treatments of chromatographic analysis are mainly based on adsorption isotherms, it is appropriate that an account of chromatography should be preceded by a treatment of adsorption. To those primarily interested in the use of chromatography for solving problems of separation, and because the book is a volume in a series on *Technique of Organic Chemistry*, it may appear that the methods

and theory of batchwise adsorption, treated extensively in books dealing with surface phenomena, have occupied a disproportionate amount of space. After a careful study of the book, there will be general agreement that a full understanding of the nature of adsorption and adsorbability greatly facilitates an understanding of the principles of chromatography in all its aspects.

The first four chapters cover the molecular aspects of adsorption, measurement of adsorption and treatment of the data, relations between adsorbability and properties of phases, and relations between relative extent of adsorption and properties of adsorptives. Adsorption in relation to molecular weight and melting point has not received adequate attention; better examples than toluene and acetic acid could have been cited to illustrate the dependence of adsorption on molecular weight. Chapter V summarizes these relations, and discusses the gradation of eluents and adsorbents. Chapters VI and VII on batchwise adsorption and decolorization are followed by three chapters on chromatography, classified conventionally as adsorption, ion-exchange and partition chromatography. The theory of each method is explained very clearly; apparatus, materials and manipulations are described; some applications of chromatography are mentioned and numerous references are given to books, reviews and papers from which details of specific applications can be obtained. Correlations between adsorption and chemical structure are considered in Chapter IV, but the chapters on chromatography do not include a discussion of the relation between the chemical constitution of organic compounds and their chromatographic adsorbability. It is curious that the word "carotenoids" does not occur in the index of a book on chromatography.

This book is the best available account of the basic principles of adsorption and chromatography, and is indispensable to every chemist.
K. V.

Flour Milling Processes. By J. H. Scott. (Chapman & Hall Ltd., London), 1951. Pp. 690. Second Edition. Revised. Price 55 s. net.

Striking improvements have been made in recent years in appearance and detail of milling machinery though the functional design has undergone little change. Flour milling research has received first-rate attention at the hands of flour millers, engineers and nutritionists. Introduction of automatic controls, pneumatic materials handling and fire prevention methods are important forward steps in milling industry.

This book deals with modern aspects of flour milling process in a very comprehensive manner. In Part I of the book various operations to which normally wheat is subjected before being milled are adequately discussed giving a brief description of the machines used. The physico-chemical and milling aspects of wheat conditioning have been discussed. Significance of Bushel Weight to millers is described and various factors modifying the bushel weight of clean wheat are discussed.

Part II of the book deals with the "gradual reduction" milling system commonly used throughout Britain, and contains valuable information; both theoretical and practical, on various aspects of milling. The working of Break Rolls, Plansifters, Centrifugals, Purifiers and Reduction Rolls is discussed in great detail. Physical and chemical characteristics of various mill flours are given. Informative and highly useful chapters on mill exhaust, power, flour bleaching and insect infestation and control have been included. The book contains an appendix giving useful engineering data on milling machinery.

The author has indicated possible trends of future developments in milling and has ventured to give his ideas of a Flour Mill of the future. The book is strongly recommended to students of flour milling and to practical flour millers.

D. S. BHATTIA.

A Text-Book of Plant Pathology. By Edgar F. Vestal. (Kitabistan, Allahabad), 1950 (appeared in July, 1951). Pp. xxi + 645. Price Rs. 19-12-0.

When Dr. Vestal came to India to teach Plant Pathology at the Allahabad Agricultural Institute over 10 years ago, he became painfully aware of the lack of a suitable text-book. Butler's *Fungi and Disease in Plants* was out of print and information on Indian plant diseases was not easily available. A compilation of "Notes on Plant Pathology" was therefore a necessary corollary. The first set of "notes" was printed in 1941 and a revised version appeared in 1946. Before leaving India he decided to publish the "notes" in the form of a "text-book."

An introduction of 11 pages is followed by 14 chapters of which the first five are devoted to fundamental topics like fungi causing plant diseases, their classification, dissemination of plant diseases, methods of plant disease control, etc. The rest of the chapters deal with the more important plant diseases found in Northern India.

A cursory reading of the book has amazed the reviewer of the spelling mistakes, errors

of grammar and of facts. This book should not have been published or be placed in the hands of students, research or extension workers.

Only a few spelling mistakes can be pointed out here. "Burrell" for Burrill, "doddar" for dodder, "conoidiphorese" for conidiophore (p. 11), "Oomceies" for Oomycetes (p. 40), "Stagnospora" for Stagonospora (p. 72), "Keshwala" for Kheshwala, "Sclerotia" for Sclerotinia (p. 150). While such mechanical errors can perhaps be excused, it is difficult to gloss over errors of fact. Botanists will be amazed at the statement that Benthams and Hooker published *Floral Studies in India* (p. xii). The *Phycomycetes* are stated to be often referred to as the downy mildews (p. 7). This is a very serious mistake because only some genera of one family of this class are known by that name. We are told (p. 11) that antheridia and oogonia "are developed on semi-sclerotial masses of mycelium". The basidium (p. 15) is stated to be "mycelium produced when resting spore germinates." According to the author (p. 24) the reproductive stage of the *Fungi Imperfecti* is the vegetative stage. Apparently he means the asexual stage. The antheridium (p. 41) is referred to as a gamete; apparently the author means a gametangium. *Tilletiaceae* are stated to consist of two genera (p. 68) but three are described. The author (p. 70) states that in the class *Fungi Imperfecti*, "the perfect stage is not known or if known, it has been only recently discovered and the fungus has been listed among the *Fungi Imperfecti* for so long that it has been widely published in literature in that group and it is retained among them for simplicity." The meaning of this sentence is not clear.

All the names and synonyms of the species causing the bunt of wheat are given (p. 173). It would have been better if the author had given the accepted name of the organism. The "Karnal" or "partial bunt" of wheat is stated to be due to *Tilletia indica* and the name *Neovossia indica* is rejected for reasons which are not clear by a perusal of the account given in this "text-book." In a book published in 1950, it is amazing to read the statement "the life-cycle and mode of infection are essentially the same as for the other bunts of wheat". The author is apparently completely unaware that the disease has been shown to be not seed-borne; even the control measure which he recommends (p. 177) is absolutely misleading.

The author has described the "Take-all" disease of wheat (pp. 190-81) which is surprising; for it does not occur anywhere in northern or in any part of India, excepting in the writer's "text-book." He is confused about the causal

organisms of some of the diseases, especially the downy mildew; the loose-smut of jowar is stated to be due to *Sphacelotheca sorghi* and the grain smut to *Sphacelotheca cruenta*, whereas the case is otherwise. The name of the causal organism of the long smut of sorghum has been left delightfully vague. The reviewer came to know for the first time that *Verticillium* wilt of potato occurs in India. The fact is until 1950, no species of the genus *Verticillium* had been recorded for India and the one recorded is not on the potato. In his description of bunt of rice (p. 340), the author does not apparently know the change in the name of the casual organism and the method of transmission of the disease; the control measure he has given is totally unsuitable.

It is understood that an "Errata list" is in preparation but the only solution which the reviewer would like to suggest is that this edition should be, in the interest of all concerned, immediately withdrawn and a new revised edition published.

B. B. MUNDKUR.

Intermediate Practical Chemistry. By Sylvanus J. Smith. (Published by MacMillan & Co.), 1951. Pp. vii+248. Price 8sh. net.

Of its five sections, the first deals with quantitative analysis. The brief discussion on the theory of indicators is interesting. Precipitation methods involved in volumetric analysis is dealt in detail using the estimation of halogen ions, with a clear explanation of adsorption indicators. Numerous oxidation reduction reactions have been considered with due attention. The section includes an interesting discussion on the use of alkaline potassium permanganate solution in the estimation of formic acid. Iodimetry is discussed in detail. The use of titanous sulphate and ceric sulphate is also included.

The second section deals in detail with the various techniques involved in Gravimetric analysis. The use of organic reagents in inorganic analysis is mentioned briefly. A note on colorimetric method is also included.

In the section on 'Physico-chemical measurements', a limited number of experiments have been described and the treatment is not exhaustive, particularly from the view-point of advanced students.

The fourth section deals with organic preparations and the preparations considered are up to the standards of Hons. course.

An exhaustive treatment of systematic qualitative analysis together with the theoretical background forms the last section of the book. Methods of analysis, dry tests and spot tests

form an interesting portion of this section. Group separation is treated in detail.

Experiments described in the book are for B.Sc. and B.Sc. Hons. course of our Universities. The printing is very pleasing. The book is edited with much care and the get-up is very attractive.

K. S. SESHADRI.

CWIN Research Station, Poona: Annual Report (Technical), 1948.

A perusal of the Report of the Central Water Power Irrigation, and Navigation Research Station for the year 1948 convincingly proves, if proof is necessary, of the importance of hydraulic research in the development of river resources in the country. The high standard of work for which it is justly famous has been maintained.

Notable among the experiments carried out during the year were those pertaining to the improvement of the navigability of the Hoogly estuary, the Cochin Harbour, the training of the Ganga River at Garmukteswar, the Tapti at Surat, the Khipra at Ujjain and the Kuakhai at Bhuvaneswar. Experiments have also been carried out on spillways, dams and appertinant works.

Every experiment has been done with great care and the reports contain all the data necessary for proper appreciation of the results obtained. The get-up and printing of the book could be improved.

N. S. GOVINDA RAO.

Books Received

Fats and Oils (Industrial Oil and Fat Products). By Alton E. Baily. 2nd Edition. Interscience Publishers Inc., 1951. Pp. 967. Price \$15.00.

Six-Membered Heterocyclic Nitrogen Compounds with four Condensed Rings. By C. F. H. Allen. Interscience Publishers Inc., 1951. Pp. 345. Price \$10.00.

Chemistry of Muscular Contraction. By A. Szent Gyorgyi. Academic Press Inc., 1951. Pp. 162. Price \$4.50.

A Laboratory Manual of Qualitative Organic Analysis. By A. T. Openshaw. Cambridge University Press, 1951. Pp. 95. Price 8sh. 6d.

Die Chemische Affinität. By Egon Wiberg. Messrs. Walter De Gruyter & Co., Berlin W 35, 1951. Pp. 254. Price 40 Marks.

The Interpretation of X-Ray Diffraction Photographs. By N. F. M. Henry, H. Lipson and W. A. Wooster. Macmillan & Co., 1951. Pp. 258. Price 42 sh.

Fundamentals of Automatic Control. By G. H. Farrington. Chapman & Hall, 1951. Pp. 285. Price 30 sh.

SCIENCE NOTES AND NEWS

Geuns Helicoceras Linder

Sri S. Y. Padmanabhan, Mycologist, Central Rice Research Institute, Cuttack, writes as follows:

Sri. Daya Nand Pant, in a communication published in *Current Science*, Vol. 20, No. 8, August 1951, p. 212, claims to have recorded the Genus *Helicoceras* Linder for the first time in India. Attention may be drawn in this connection to the *Annual Report of Central Rice Research Institute*, 1948-49, p. 26, wherein *Helicoceras nymphæarum* (Rand.) Linder was reported to have been isolated from rice grains. The identification of the fungus was confirmed by Dr. Hughes of the Commonwealth Mycological Institute, England.

Food Plants of the Desert Locust

Referring to Sri. K. B. Lal's letter on *Food Plants of the Desert Locust*,* Sri N. N. Sen, Conservator of Forests, Land Management Circle, U.P., writes as follows:—

"It would be interesting to note that when some locusts settled down in June 1951, in Kukrail Forest Block, near Lucknow, they went selectively for the babul (*Acacia arabica*) trees only and did not touch any other species. There were a number of mango (*Mangifera indica*), mahwa (*Bassia latifolia*), neem (*Azadirachta indica*), reonj (*Acacia leucophlaea*) and cheonkar (*Prosopis spicigera*) and other species in the immediate neighbourhood.

* *Curr. Sci.*, 1951, 20, p. 165.

Control of the Indian Bookworm

The following recommendations are made regarding the control of infection of the larvæ of the bookworm, *Gastrallus indicus*:

The infected material should be air-heated in small lots, in suitable ovens at 60° C. for 4 hours or at 70° C. for 3 hours. Higher temperatures are not recommended as they would adversely affect the durability of paper, palm-leaves, etc. But should such an adverse effect be of no consequence (as in the case of the library cards), exposures to higher temperatures may also be made.—(By courtesy of the *Indian Forester*, 1951, 77, 511).

Technetium in the Sun

C. E. Moore (*Science*, 1951, 114, 59), has pointed out that spectral evidence suggests the existence in the Sun of the recently discovered element, 43, technetium. Comparing the wavelengths of the intense low level lines in the laboratory spectra of Tc I and Tc II with those of the lines in the solar spectrum, none are found corresponding to Tc I, either due to the lines falling on top of those due to other elements, or occurring in a region where they are masked by the continuum. In Tc II also, some of the lines coincide with those due to other elements, but the hitherto unidentified solar line at 3195.23 Å agrees well with the line at 3195.21 Å in the laboratory spectrum. None of the lines appear to be definitely absent, so that if technetium exists in nature, the above evidence would indicate the possibility of its presence in the Sun.

Nuffield Foundation Travelling Fellowships, 1952-53

It has been decided to award the Fellowships for the year 1952-53 in the following subjects:—

Two Fellowships in Medical Sciences, preference being given to candidates wishing to study (1) Pharmacology, and (2) Industrial Medicine; one Fellowship in Engineering, preference being given to candidates wishing to study Hydraulic Engineering or Agricultural Engineering; one Fellowship in Natural Sciences, preference being given to candidates wishing to study Industrial Standardisation and Quality Control. It is estimated that the total value of an award (exclusive of travelling expenses) will be at the rate of from £ 770 to £ 890 a year, according to individual circumstances.

Applications for Fellowships for 1952-53 (one original and three copies) should be submitted not later than 15th January, 1952, to the Secretary, Nuffield Foundation Indian Advisory Committee, Planning Commission, Government House, New Delhi, from whom copies of the form of application may be obtained.

Dye Extracts from Tamarind Seed Testa

Recent investigations carried out at the Forest Research Institute, Dehra Dun, have resulted in the development of a process by which it is

possible to obtain dye extract at a cost of about 9½ annas per pound from tamarind seed testa. The process in question has been patented and full rights of ownership therein now vest in the Central Government.

According to this process, the dye can be extracted from the testa in a standard form which has been found to give uniform and dependable results in dyeing and which in cost of dyeing compares favourably with the coal-tar acid dyes.

Any person or firm desirous of undertaking the exploitation of the process is requested to communicate direct with the Secretary, Patents Advisory Committee, Ministry of Commerce and Industry, Government of India, New Delhi, for further information.

Inventory of Research Equipment

Following the suggestions from a number of research workers, three types of data forms were prepared by the UNESCO South Asia Science Co-operation Office, New Delhi, and sent out to the Heads of the University Departments and research institutions to furnish information on the special apparatus, rare chemical and type cultures, etc., which they consider unique acquisitions in the laboratories. The value of the proposed inventory will be gauged by the information available which may help another institution to plan its laboratory equipment or to plan any research work. Very soon the collected information will be compiled and it will be appreciated if those who could not send the information earlier will kindly do so now.

Dr. K. R. Ramanathan

Dr. K. R. Ramanathan, Director of Physical Research, Ahmedabad, has been elected President of the International Association of Meteorology for the triennium, 1951-54.

Dr. B. R. Nijhavan

Dr. B. R. Nijhavan, Assistant Director, National Metallurgical Laboratory, Jamshedpur, has been elected a Fellow of the Institution of Metallurgists, United Kingdom.

Industrial Plants from Germany

India's war reparations from Germany include a Methanol Plant, a T.N.T. Factory, a Glycerine Plant, a Precision Machine Tools Manufacturing Factory and an Electric Steel

Smelting Furnace. The Methanol Plant from the Badische Anilin Soda Fabrik, Ludwigshafen, is valued at Rs. 5,30,282. It is meant for the production of methanol from the stage of compression of raw methane gas to a synthesis of 90 tons of pure methanol in 24 hours. It is expected that the plant will be taken up by the Sindri Fertilizer Factory.

Valued at Rs. 1,74,888, the Trinitrotoluene (T.N.T.) Factory is capable of producing 12 tons T.N.T. in 24 hours at the rate of 4 tons per charge and 3 charges per day. This plant has been retained for use by the Ordnance Factories.

European Brewery Convention

At a meeting of the Council of the European Brewery Convention, it was decided to hold the next Congress in the south of France, the subjects for discussion being: (1) the relation between the analytical figures of the barley and the malt and the physicochemical stability of the beer, and (2) the control of spoilage organisms in beer.

To facilitate the exchange of brewing students between different countries, each country was asked to prepare a list of breweries willing to accept such students.

Indian Association for the Cultivation of Science

At the Annual General Meeting of the Association held recently, the following Office-bearers were elected for the year 1951-52:—

President: Dr. J. C. Ghosh; **Vice-Presidents:** Dr. D. M. Bose and Prof. M. N. Saha; **Honorary Director:** Prof. P. Ray (*Ex-Officio*); **Members:** Dr. S. K. Banerji, Hon'ble Sri. C. C. Biswas, Dr. K. Biswas, Dr. S. R. Bose, Dr. P. N. Brahmachari, Sri Dwijesh Chandra Chakraborty, Dr. Satish Chandra Ganguly, Dr. M. S. Krishnan, Prof. P. C. Mahanti, Dr. Shyamaprasad Mookerjee and Sri Nagendra Nath Sen.

The Electrochemical Society: India Section

At the First Annual Meeting of the India Section of the Electrochemical Society held at Bangalore on August 2, 1951, the following Officers were elected:—

Chairman: Dr. B. K. Ram Prasad (Bombay), **Vice-Chairmen:** Mr. J. Balachandra (Bangalore) and Mr. K. Rajagopal (Mettur Dam), **Secretary-Treasurer:** Dr. T. L. Rama Char (Bangalore).

JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

ANNOUNCEMENT

The schedule of advertisement charges in the **Journal of Scientific and Industrial Research** has now been raised, and the new rates come into force from **August 1949**. The revision will be without prejudice to existing contracts and will take effect after the expiry of the contracted period.

The revised rates are as follows :

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12 Insertions	Rs. 500	Rs. 275	Rs. 150
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